THE RAILWAY GAZETTE
A Journal of Management, Engineering and Operation
INCORPORATING
Railway Engineer · TRANSPORT · The Railway News
The Railway Times · Herapath's Railway Journal ESTABLISHED 1835 · RAILWAY RECORD.
RAILWAYS ILLUSTRATED · RAILWAY OFFICIAL GAZETTE

PUBLISHED EVERY FRIDAY
AT
33, TOTHILL STREET, WESTMINSTER, LONDON, S.W.1
Telegraphic Address: "TRAZETTE, PARL, LONDON"
Telephone No.: WHITEHALL 9233 (6 lines)

Annual subscription payable in advance and postage free
British Isles and Abroad.....£2 5s. 0d.
Single Copies.....One Shilling
Registered at the General Post Office, London, as a Newspaper

VOL. 69. NO. 8 FRIDAY, AUGUST 19, 1938

CONTENTS

ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with every copy of this week's issue

Gifts Abused

THE British Association, at present holding its meeting in Cambridge from August 17-24, is clearly apprehensive that popular talk about "abusing the gifts of science" may cause the scientist himself to occupy a place alongside other modern bogeys in the skittle-alley of public opinion. A section of the presidential address by the Rt.-Hon. Lord Rayleigh was specifically devoted to "Science and Warfare," and here the speaker showed that even such sinister aids to destruction as mustard gas and thermite were first prepared in a spirit of innocuous scientific curiosity. Sir William Roberts Austen, lecturing on "Metals as Fuel" in 1901, did indeed show a practical use of thermite in heating metal work locally for making welds, but Watts's "Dictionary of Chemistry" in 1894 judged dichlordiethyl sulphide (mustard gas) as worthy of no more than a 40-word entry. A somewhat similar defence, but of the engineer, was argued by Professor R. V. Southwell in addressing the Engineering Section of the meeting. In blaming the scientist for the horrors of modern warfare, he considered, public opinion was merely expressing the deep-seated desire to pass on responsibility. The engineer was no more culpable because his machines were used for destruction, than was the geneticist because no better use for the plenty of the earth had been found than destroying food while thousands were in want.

The Gornergrat Railway

On August 20 of this year there will be celebrated the fortieth anniversary of the opening of the railway from Zermatt to the summit of the Gornergrat in Switzerland. Not only was this one of the earliest of the Swiss mountain lines, but the remarkable nature of the enterprise is apparent when it is recalled that this is still, by an easy margin, the highest railway track in Europe laid entirely, save for a very short tunnel near Riffelalp, in the open air. Indeed, its maximum altitude of 10,236 ft. is surpassed in Europe only by the 11,340 ft. of the upper terminus of the Jungfraujoch line; but the last 4 miles of the latter, from an altitude of just over 8,000 ft. upwards, are in tunnel. The Gornergrat ridge, an isolated expanse of rock encircled on one side by the great sweep of the Gorner glacier, but itself normally free from snow in the height of the summer, was fortunately well suited in its configuration for the building of a track with a ruling gradient of 1 in 4, and apart from the high cantilever bridge over the Findelen gorge, no engineering works of any magnitude were needed. From Zermatt to Gornergrat the difference in level surmounted by the Gornergrat Railway is 4,920 ft. in a journey of 6 miles, completed in 70 min., and throughout almost its entire length commanding some of the finest glacier panoramas in the whole of the Alps.

* * * *

The Week's Traffics

Traffics of the four main line railways for the past week were £238,000 behind those for the corresponding week in 1937, following a decrease of £240,000 for the previous week. From passengers the receipts were £40,000 lower, merchandise receipts were down £166,000, and coal receipts were £32,000 less. For the corresponding week in 1937 passenger train traffics were £56,000 up, and in merchandise there was an increase of £19,000, but coal earnings were down £6,000 net. Aggregate earnings of the four companies to date are £97,593,000, a decrease of £3,071,000 or 3·05 per cent.

	32nd Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	– 23,000	– 83,000	– 6,000	– 112,000	–1,295 000	– 3·19
L.N.E.R. ..	– 1,000	– 49,000	– 18,000	– 68,000	–1,039,000	– 3·52
G.W.R. ..	– 7,000	– 28,000	– 8,000	– 43,000	– 579,000	– 3·41
S.R. ..	– 9,000	– 6,000	—	15,000	– 158,000	– 1·16

London Transport receipts for the past week amounted to £526,000, a decrease of £3,400, but for the seven weeks of the present financial year they were £3,944,300, an increase of £30,700.

* * * *

A Timetable Revolution

The remarkable character of the timetable reorganisation in Holland (see p. 325) becomes more apparent when an examination of the new services is made on a statistical basis; indeed, it is safe to say that as a wholesale acceleration of train service, nothing comparable to it has ever been seen previously in Holland or any other country. For example, prior to May of this year there were no runs in Holland timed as fast as 60 m.p.h. from start-to-stop; now there are 227 such runs daily, including 103 timed at 62 m.p.h. and over, 56 timed at 64 m.p.h., and 36 timed at 67 m.p.h. and over. In a country so densely populated as Holland, the average length of run is, of course, short; the aggregate mileage of runs at 67 m.p.h. and over is 648, at 62 m.p.h. and over 2,202, at 60 m.p.h. and over 3,862, and at 58 m.p.h. and over no fewer than 313 runs, aggregating in length 5,090 miles, are shown in the timetables. The proportion of these totals that is worked respectively by multiple-unit electric trains and independent diesel-electric units is

roughly half-and-half, with the electric services slightly predominating. As a result of such speed it is possible to travel by rail for considerable distances across Holland, inclusive of numerous stops, at average speeds round about the mile-a-minute mark.

* * * *

Speed in Holland

The new timetables reveal the fact that Holland has now joined the countries in Europe in which timetable bookings at over a mile-a-minute are to be found, though as yet these are not achieved with steam propulsion. By the use of the latest streamlined three-car electric units, with buffet accommodation, it is possible to show a start-to-stop schedule at 67·1 m.p.h., from Dreibergen to Ede, 17·9 miles in 16 min. With diesel-electric propulsion, the quickest run is over the 41·5 miles from Amersfoort to Zwolle in 38 min., at 65·5 m.p.h. These and other timings almost as fast are now standardised throughout the day in the schedules over the routes concerned. With steam the fastest journey is also from Amersfoort to Zwolle, but the steam-hauled trains require 45 min., or 7 min. more than the diesel-electrics, which works out at 55·3 m.p.h. Amersfoort—Zwolle is the longest non-stop run on the standardised Dutch internal services, but longer journeys are made by the international trains on Dutch soil, the maximum being over the 74·7 miles from Flushing to Tilburg in 91 min. (49·2 m.p.h.), followed by the 69·4 miles from Amersfoort to Hengelo in 90 min., at 46·2 m.p.h. In view of the numerous service slacks, these are smarter timings than their average speeds might appear to indicate.

* * * *

The Stockholm Railway Museum

A really complete railway museum is something of a rarity, but Sweden has preserved a very representative collection, though as yet there is no permanent museum building in which to house it. Small exhibits and models are kept in the State Railways administration building at Stockholm Central station, and full-size rolling-stock in some old carriage sheds at Tomteboda, which house no fewer than eleven locomotives belonging to the Swedish State Railways, four locomotives from private railways, 23 carriages from the State Railways, and eight carriages from private railways. Among the wide variety of the smaller exhibits is a collection of models of bridges, train ferries, snow ploughs, stations and rolling stock, as well as portraits, busts and a large number of very fine photographs. Specimens of early telegraph instruments, signalling appliances, 3,000 tickets, uniforms, train-lighting installations from the earliest candle-lamps, and all kinds of curiosities, fill several rooms. Even the gorgeous furniture of the original head office of the State Railways has been preserved. The policy of the museum is " not merely to present the history of the Swedish railways from the earliest days, but also to give a picture of those railways as they work today, forming the great mainstay of the country's transport system." A photograph of one of the early locomotives is reproduced on page 330. An illustrated article dealing with other aspects of the museum appeared in our issue of July 24, 1936.

* * * *

An Indian Accountancy Experiment

A welcome change, even if it is only experimental, is to be made upon Indian railways. Hitherto chief accounts officers and their staffs have been responsible to the Financial Commissioner of Railways and not to general managers. The result has been that their outlook has been far more critical than constructive. On July 15, however, the Public Accounts Committee of the Government of India decided by a small majority to adopt a proposal that these officers should be placed to the fullest extent practicable under the control of the general mangers on two railways, the underlying idea behind the proposal being that such a change would provide an incentive to accounts officers to assist the administration as constructive advisers. This experiment is in accordance with the recommendations of the Pope Committee and others, and should be a firm foundation for building up a sound structure combining the commonsense outlook of the technical or specialist officer with the financial acumen of the accounts officer in the administration of each railway. As in other countries, the result is bound to increase administrative efficiency, and the change is long overdue in India.

* * * *

Indian Railway Finances in 1937-38

Approximate figures in the final accounts of Indian railways for the year ended March 31, 1938, are now available and show a surplus of Rs. 2¾ crores, or roughly £2,000,000. This figure, though it is Rs. 8 lakhs (£60,000) lower than the revised estimates prepared in February last, is still Rs. 1·3 crores (Rs. 130 lakhs, or near £1 million) higher than the actuals for 1936-37. As it has been decided to postpone until April 1, 1940, repayments of loans taken from the depreciation reserve fund during the lean years—aggregating Rs. 32½ crores—the surplus will be paid to general revenues; actually it is short of the contribution due this year by Rs. 1½ crore. Altogether, Rs. 62½ crores were borrowed to make good deficits between 1931-32 and 1937-38, of which approximately Rs. 30 crores came from the depreciation reserve fund. The decision to delay repayments to that fund is dependent upon the Government of India Act, and the Federal Government is allowed freedom of action in the matter under the Act.

* * * *

Portuguese Railway Company

In 1926 this company took over the working of the State railways previously operated by the Government, and since 1930 trade depression and road competition have had a dire effect on receipts, while rising prices of coal and materials have meant a constant increase in working expenses. The company actually owns 1,119 km. of line, with 50 km. worked under contract, while the State lines (that is the Minho—Douro and the Sul e Sueste) total 1,351 km. Working results for the whole system in 1937, compared as follow:—

	1937	1936
Length of line, km.	2,520	2,520
Passengers	16,721,702	16,396,047
Goods, tons	3,567,929	3,588,106
Train kilometres	12,783,000	12,785,071
Operating ratio, per cent.	91·52	86·84
	Contos	Contos
Gross receipts	240,719	248,859
Working expenses	220,295	216,110
Net earnings	20,424	32,749

The receipts of the company's own system, less tax, were 154,117 contos, and expenses 131,551, leaving net receipts 21,487 contos. Discounting 12,118 contos for the service of obligations and other financial charges, a small remainder is left of only 17 contos. The lines leased from the State show an even worse result, as traffic receipts, at 85,268 contos, were exceeded by working expenses, at 86,186 contos, leaving an operating shortage of 918 contos, increased by appropriations and fixed charges, to a total deficit of 10,859 contos. The railway problem in Portugal was reviewed in our Overseas columns on April 22 last, and again more recently on July 1.

The Rutherglen Derailment

Major G. R. S. Wilson's report on the derailment of a passenger train on April 8 at Rutherglen, L.M.S.R., will be found summarised on page 338. The accident was similar to that at Crewe on April 14, 1937, in that an axle broke in consequence of an undetected flaw; but in this case the train was travelling at 50 m.p.h., and it is remarkable that the consequences were not more serious. The failure occurred at the front of the leading coach. All four vehicles in the train left the rails, but the last one, in which all the casualties occurred, unfortunately mounted a platform ramp, was overturned and considerably damaged; one passenger was killed and another fatally injured. The flaw, which, it is thought, may have been in existence about two years, was probably initiated by a tool mark and had gradually extended over 81 per cent. of the cross-section of the axle. Being close to the wheel seat, it was very difficult to detect. Axle failures are extremely rare—3 per annum in the last 6 years—but steps are being taken by the L.M.S.R. still further to prevent similar flaws originating, the wheel seats being increased in diameter on new axles for all classes of coaching stock and finished in an improved manner. Similar treatment is being adopted for the entire axle in L.M.S.R. high speed stock, as detailed in our summary. No blame is attached to anyone in connection with the derailment.

* * * *

A World Record

The recent L.N.E.R. speed record with a locomotive fitted with the Kylchap exhaust arrangements has prompted an inquiry as to the highest speeds that have been attained by engines of the French Chapelon Pacific type, which are noted for the freedom with which they both raise and exhaust their steam. On page 339 of this issue we print an authoritative communication on this subject, from which it will be seen that no serious attempt at ascertaining the maximum speed capacity of one of these locomotives has yet been made, the highest yet on record being 108 m.p.h. down a 1 in 200 grade with a load of 393 tons, and 102 m.p.h. on the level with 296 tons. We have also received an official communication from Germany to the effect that the highest speed yet attained by one of the streamlined 4-6-4 locomotives on a test run between Berlin and Hamburg, measured with the extremely accurate appliances of one of the Reichsbahn dynamometer cars, was 200·4 km.p.h., which works out at 124·5 m.p.h. and not quite the 125 m.p.h. that has been quoted. This was on the level, but we have no information as to the load hauled. We have previously emphasised that the extremely approximate methods of speed estimation of earlier days put such figures as the American 127 m.p.h. of 1905 out of court as records, even if the technical development of locomotive design at that period permitted such a speed, which is extremely doubtful. The London & North Eastern Railway therefore appears fully entitled, with *Mallard's* maximum of 125 m.p.h. (actually for a very short distance 126 m.p.h. was found on the dynamometer chart) to claim a world record for steam.

* * * *

Making Money with Locomotives

A paper with the above title was read by Mr. Robert S. Binkerd of the Baldwin Locomotive Works at a recent meeting of the Southern & Southwestern Railway Club at Atlanta, and provided some very useful data connected with U.S.A. railway locomotive practice. He insisted that it was wrong to suppose that high mileage could be made only on long railways or as a result of long runs. The Lehigh Valley Railroad, for instance, is only 454 miles in length, yet some 4-8-4 class engines thereon are averaging about 100,000 miles a year. The New Haven Railroad operates steam trains from New Haven to Boston, a distance of only 157 miles, and here two round trips a day by most of its 4-6-4 engines built a few years ago by the Baldwin Company can easily produce an average annual mileage in excess of 125,000. Long runs, as Mr. Binkerd went on to say, are not the only way of intensifying locomotive use. In heavy high-speed main line services, whether on long runs or short, there is no mechanical reason why many more performances of 125,000, 150,000 and even 175,000 locomotive-miles a year should not be achieved. This would radically reduce the number of engines required for the service, correspondingly reduce expenses, and make money all along the line.

* * * *

Traffic Stops and the Coal Bill

A discussion which followed the reading of a paper by Mr. C. Case at a meeting of the Institution of Locomotive Engineers, South American Centre, brought out several interesting points. The speaker called attention to the effect on locomotive coal consumption produced by what he called " unnecessary " traffic stops, and stated that a traffic department allowing such unnecessary stops with heavy tonnage trains was responsible for the burning of much extra coal. He pointed out that the cost of the unnecessary train stop was being closely calculated today in Canada and the United States. The time and cost of stopping a passenger train from a speed of 50 m.p.h. and accelerating to that speed again was 3 min., with cost placed at 50 cents (2s. 0d.). A freight train comprised of 50 vehicles brought to a standstill from 25 m.p.h. lost 9 min., and the cost was $2 (8s. 1d.). The Committee of Trial Tests of the Association of Mechanical Railroads reported a 1,400-ton train of 25 loaded and 7 empty wagons, accelerating from stop to 45·8 m.p.h., required 5 min. 12 sec. and consumed $1.60 (6s. 5d.) worth of energy. The report went on to say that although the time lost in making train stops was readily measured with accuracy, figures as to the actual amount of money wasted had been accepted with some degree of hesitation.

* * * *

A Poet on Railway Policy

Examples of poets who have strenuously opposed the establishment of railways are more often quoted than of those who have publicly proclaimed themselves in their favour. An incident of the latter kind, however, was recalled recently in Paris, when at a meeting of the Institut Scientifique des Etudes des Communications et des Transports the speech delivered by M. de Lamartine to the Chamber of Deputies in May, 1838, was recited in full. Alphonse de Lamartine, some of whose poems express a sense of hopelessness at the speedy passing and irrevocability of human life, showed himself in this speech a virile protagonist of railway building. He condemned construction by private enterprise, partly because he alleged that disputes led to delays in the realisation of important work, but no less vehemently because he was opposed on policy grounds to the projected linking by private enterprise of Paris with the Channel coast. Lamartine demanded that preference should be given to the railway to Lille, to be built by the State because all enduring works of national importance in France had been so constructed. In this way a Franco-Belgian alliance might be created, and, cried Lamartine: " Never again will troops from the German States camp on your very frontiers! Belgium is your fortress; your battle-field! "

Developing Excursion Traffic

THE Ministry of Transport statistics reveal that the British railway companies are deriving a steadily growing proportion of their passenger train revenue from passengers conveyed at less than the standard or ordinary fares. This is largely due, of course, to the popularity of the monthly return ticket, the cost of which is about the single fare and one-third. During the last two or three years, however, the railway companies have devoted special attention to the development of day and half-day excursion traffic, and from the marked increase in the number of passengers patronising these trips, and the satisfactory train loadings which are secured, it is apparent that they make a strong appeal to the public. The trips are characterised by novelty, speedy and comfortable travelling, and extremely reasonable fares. In order further to develop this potential traffic the companies are constantly evolving new and interesting trips involving in many cases countryside outings by rail and road, or rail, road and river steamer excursions. These vary from a conducted tour through Windsor Castle, with tea on a Thames river steamer *en route* to Magna Charta Island, to organised rambles through the New Forest with capable guides, and day trips by rail and road through the Shakespeare country, the Peak district and Lincolnshire and Suffolk. What are termed "educational outings" are also run frequently to large industrial and railway works, although as yet there have been no excursions in this country catering as thoroughly for the numerous interests of the railway enthusiast—including his appetite for photographing engines—as some have done in the U.S.A. A specimen itinerary of this kind was commented upon in our issue of December 11, 1936. But the British railways meet the same demand to some extent by their generous treatment of the recognised railway enthusiasts' societies in the matter of cheap party travel and facilities for visiting railway premises. Other types of British railway excursion are those to such places as Bath, which, with a conducted tour of the famous baths and Pump Room and an attractive motorcoach tour of the surrounding countryside, including tea, costs only 11s. 3d. for passengers from London. Conducted tours on Sundays include a visit to Winchester for 5s. 9d.; to Canterbury for 5s. 3d.; and to Quarr Abbey in the Isle of Wight for 10s. 9d.

The term "day-trip" is a somewhat elastic one when applied to certain long distance excursions which are remarkable for the mileage covered. Special tours are run, for instance, by the L.M.S.R. from Euston to Oban, in Scotland, for steamer cruises to the islands of Staffa and Iona, 1,100 miles being covered between Friday evening and Sunday morning at a cost of less than £2. To the West of England, outings are arranged to Devonshire, with a road trip to Buckfast Abbey, or a river steamer cruise from Totnes to Dartmouth, occupying about 14 hours at a cost of less than one shilling an hour. To Wales, a trip to Llanberis with breakfast, and the ascent of Snowdon, can be made for 26s., including a motorcoach tour to Caernarvon, and return thence by rail can be made for only 26s.; or with a motorcoach tour through the Aberglaslyn Pass to Portmadoc, and by narrow gauge railway to Blaenau Festiniog, thence by ordinary train to Llandudno, the fare is only 30s., including breakfast and tea. Another innovation is cheap night travel from Marylebone, L.N.E.R., to the north-east coast, special trains leaving London every night for holders of night travel (half-fare) tickets, and conveying day excursionists on Fridays.

Even more enterprising than the foregoing are trips from London to France, Belgium and Holland. An excursion to Rouen, including a ramble through the surrounding countryside, giving 22 hr. in France, can be made for only 25s., while a trip to Brussels, including a conducted tour around places of interest, and three meals *en route*, costs only 30s. On Saturdays a number of specially conducted day tours are available for the more ambitious traveller. These include visits to Arras and Vimy, Amiens and the Somme for £2, and to Ypres for 39s. 6d., with meals provided *en route*. Other interesting Continental tours afford passengers sixteen hours on the Belgian coast for 27s. 1d., or seventeen hours in Holland for 57s. 7d. Week-end and mid-week cruises by railway companies' steamers are also run during the summer, those from Southampton being destined for France or the Channel Islands and those from Harwich for Holland, Belgium or France. Deck games and interesting shore excursions are features of these excursions, for which no passport formalities are necessary. These various trips are merely indicative of hundreds of trips arranged by the railway companies which enable places of scenic or historic interest, both in this country and on the Continent, to be explored with the minimum of fatigue and expense.

* * * *

Timetables

THERE are many members of the general public who regard the search for trains in a British railway timetable as a task for experts only, and with every successive issue of the timetables their complexity would appear to become greater rather than less. For example, the latest public timebook of the Southern Railway compresses into one vast table, extending over no fewer than 76 consecutive pages, the train services of the Central Division between the London terminals and all the South Coast resorts from Hastings to Portsmouth, as well as the coastal services. This is a distinct improvement; but a traveller from say Eastbourne to Worthing must run through several pages of both the "down" and "up" sections of the table to find his connections at Brighton. Some of the suburban tables, such as "London, Blackheath, Woolwich, Dartford, Gravesend Central, and Allhallows-on-Sea," with its 40 pages, also present some formidable complications, though chiefly if any journey slightly out of the ordinary, and involving connections, requires to be made.

One bane of the British timetable is its addiction to masses of information printed in the train columns, and to notes so numerous that often they exhaust the alphabet several times over. As an example of this there may be cited pp. 208-209 of the G.W.R. summer timetables, showing in summarised form the services between the West of England and the L.M.S. and L.N.E. Railways; these contain 60 train columns of moderate length, for the elucidation of which 141 separate notes are required, occupying 76 lines of closely-printed type. In one of the train columns on p. 119 of the London & North Eastern timetables we read "Restaurant Car (Mondays and Fridays only and not after September 2)—Liverpool Street to Ipswich. Restaurant Car (Tuesdays, Wednesdays, and Thursdays. Also Mondays and Fridays commencing September 5)—Liverpool Street to Yarmouth"; after studying which the harassed traveller probably takes a packet of sandwiches with him to be on the safe side. As all the luncheon business on this train, which does not run on Saturdays, is over by Ipswich, surely "Restaurant Car Train" might give the required information quite adequately? The L.M.S.R. timetables have their own special features, as, for example, on p. 145, where in three parallel columns there are shown (a) an express from Aberdeen to Euston, apparently non-stop from Perth to Crewe; (b) the Midday Scot from Edinburgh to Euston

calling at Carlisle, Lancaster, and Preston; and (c) an express apparently non-stop from Glasgow to Crewe and then losing itself in the West of England. All three converge triumphantly at Crewe—on the same track—at 6.48 p.m., and all three are, of course, the same train. No doubt there is a good reason why, to save such complication as well as the additional space involved, one column of the table would not suffice. These are, perhaps, extreme cases, though they are typical of timetable methods; many such insertions are doubtless prompted by the desire to give meticulously accurate information concerning the trains, but the ultimate effect is to produce timetables of vast size and complexity in which even expert readers at times find difficulty in unravelling their problems of trains and connections.

On the whole, we think that the French *Indicateur Chaix*, though not in every way perfect, is an advance over our own compilations; the nearest approach to it in this country is the timetable book of the L.N.E.R. The present *format* of *Chaix* was adopted while the French Railways were still working as individual companies, and was designed in such a way that every section, giving the services of a complete railway, could be sold separately, so forming that company's official public book. In it there are various aids to simplicity; one is that for many of the details which in the English books require printed details in the train columns—such as restaurant cars, sleeping cars, through carriages, trains running on certain days or during certain periods only—conventional signs, common to all railways, are used. Every train has its own reference number—an invariable and valuable Continental practice—and with every table a group of notes, identified by the train numbers, shows the through carriages and sleeping cars carried, as well as the portion of the journey over which restaurant car facilities are available. The only reference letters in the train columns are those relating to limited periods or days of running, for which there is a separate group of notes. A third group of notes with every table, in which the reference numbers of the trains are used, gives information as to restricted availability of tickets on particular trains, supplementary fares, and so on. The point is that the train columns in general contain times only, and are kept clear of masses of explanatory data; while the traveller knows exactly where to look for any additional information he may require, presented in a uniform style for all tables and all railways.

It is hardly necessary to labour the moral that a similar all-railway type of timetable is desirable for Great Britain. It may be claimed that *Bradshaw's Guide* fills the bill, but this is hardly correct, for the *Guide* cannot be bought in separate sections to represent the four main-line railways, only the Southern Railway as yet having adopted *Bradshaw* as its standard, and also because the latter, based exactly on the railway companies' own books, shares all their faults other than that of bulk. Further, the merciless policy of compression latterly followed by the compilers of *Bradshaw* makes some of its tables even more difficult to read than those of the railway companies' books; and something worse than compression is seen in such a *Bradshaw* table, for example, as that of the L.N.E.R. High Barnet branch, where the first morning and last evening trains are shown, but all the information vouchsafed concerning the rest of the day is " trains at frequent intervals "—notwithstanding one gap between trains as lengthy as 50 min. Should the decision be reached by the railways of Great Britain to adopt a unified timetable, obtainable as a single volume or in separate parts, it is in our judgment essential that in the interests of the users the subject of readability and simplification should receive close consideration. The invitation might well be extended to members of the general public who are timetable users to submit their views as to ways in which timetables might be improved, and in any event the matter of presenting a thoroughly serviceable compilation should not be left alone to those who themselves may have but little occasion to use the books that they have compiled with such meticulous care. The final production should be in the hands of one competent single authority for all the companies, receiving from the timetable departments all the necessary information, and then sufficiently independent to be able to present it in a manner that is subject exclusively to its own decision as what best will serve the claims of clarity.

* * * *

Danish State Railways in 1937-38

ALTHOUGH the year ended March 31, 1938, showed an increase in traffic, the financial results were considerably worse than those of the preceding year, due to enhanced cost of operation. The number of passengers carried increased by roughly a million as compared with the year before, or by 2·0 per cent., and is the largest number of passengers ever carried on the State Railways in one year. The Greater Copenhagen area attracted a further 1·7 million passenger journeys, mainly on the electrified lines, but the number of passengers carried on all other lines was down by 700,000. The cause of this decrease was that the Easter holidays in 1937 were in March—or at any rate the tickets were issued in March—whereas in 1938 they were in April, so that the financial year 1937-38 did not include the corresponding important passenger traffic. These figures do not include the State Railways bus passengers, numbering 4·7 million, an increase of 10·6 per cent. over the preceding year. The following table shows the principal results as compared with those for 1936-37 :—

	1937–38	1936–37
Length of line	2,554 km.	2,565 km.
Train-kilometrage	29,528,800	28,652,300
Steam	18,648,500	19,119,500
Diesel and petrol	8,642,200	7,382,200
Electric	2,238,100	2,150,600
Omnibus kilometrage	10,767,300	9,812,900
Total railway passengers carried	50,327,700	49,368,400
Copenhagen suburban services	32,645,900	30,942,700
Other railway services	17,681,800	18,425,700
Omnibus passengers carried	4,684,800	4,234,000
Goods and livestock tons	5,117,100	5,116 100
Financial results in Kroner		
Passenger receipts	60,630,000	59,839,000
Omnibus receipts	4,567,000	4,104,000
Goods and livestock receipts	51,086,000	50,970,000
Other receipts	7,587,000	7,187,000
Total gross receipts	123,870,000	122,100,000
Working expenses	124,410,000	117,890,000
Net receipts	— 530,000	+ 4,210,000
Depreciation charges	6,870,000	6,660,000
Interest charges	13,130,000	12,010,000
Final deficit	20,530,000	14,460,000

Of the total number of tickets issued, 65 per cent. were within the Greater Copenhagen area. Only 1·2 per cent. were first class, and, whereas 18 per cent. were single tickets, 49 per cent. were return tickets at reduced fares, and 33 per cent. were season tickets. Goods and livestock traffic was practically the same in volume as in the previous year, and the peak was reached in the earlier part of the current financial year, with a fall during the later months. It seems probable that 1937 will prove to have been a boom year and that we are now on the downward slope. On the train ferry routes a considerable number of motorcars is transported and the State Railways are now running two special motorcar ferries across the Great Belt. Altogether 287,000 motorcars and motorcycles were carried on all the ferries, an increase of 7·6 per cent. Referring

to the financial figures, we find that passenger receipts improved by 1·3 per cent., and that there was an increase in bus traffic of 11·3 per cent. Goods receipts were practically the same as the year before, In all, receipts increased by Kr. 1·9 million or by 1·5 per cent. On the other hand the working expenses increased by no less than Kr. 6·5 million or 5·5 per cent., due to higher train and bus kilometrage, and to increases in the cost of fuel and wages. Moreover a considerable sum has been devoted to improving and rebuilding passenger stock and the steam locomotives bought from the Swedish State Railways. So the net result of the working was a deficit of Kr. 0·5 million against a surplus of Kr. 4·2 million in the preceding year. When depreciation charges and interest are taken into account, the final figure is a deficit of Kr. 20·5 million.

The increase in interest charges is partly due to the Störstrom bridge having been taken into use during the year and the interest of the capital invested taken into account from that date. Owing to the closing of a small branch line the length of the system was reduced by 11 km., but in spite of this the train-kilometrage increased by 3·1 per cent. From the above figures it will be seen that diesel and petrol propulsion take an increasing part of the train-kilometrage; for the year 1937-38 the percentage was 29·3, against 25·8 in the preceding year, and steam propulsion is now responsible for only 63 per cent. of the total. On the State system there are now in service 8 diesel articulated high-speed trains, 10 diesel locomotives, 93 diesel and petrol railcars, and 62 electric motor coaches; the number of steam locomotives is 415. Bus services were run over 2,872 route-km.—against 2,730 in the preceding year—worked by 219 vehicles containing 4,914 seats.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Presenting the Facts About Accidents

Southern Railway, Traffic Manager's Office,
Operating Department, Waterloo Station, S.E.1,
August 10

To the Editor of The Railway Gazette

Sir,—I have been reading with interest the article on page 244 of The Railway Gazette for August 5, under the heading of "Presenting the Fact About Accidents," and you may be interested to know that in common with the Continental practice to which your article refers, it is already the custom on the Southern Railway to issue a separate circular setting out the principal accidents and irregularities and the circumstances connected with each. This circular, which is issued monthly, is sent to the staff of all departments concerned with the idea that the lessons to be learnt therefrom will be of general benefit.

Yours faithfully,
E. J. MISSENDEN,
Traffic Manager

The Hatchet Planimeter

Ruislip, August 12

To the Editor of The Railway Gazette

Sir,—Without in any way attempting to detract from the value of that wonderful instrument, the Amsler planimeter, described in your issue of July 15, one is sometimes tempted to wonder why another and far simpler type of planimeter seems comparatively so little known and rarely used. I refer to the hatchet planimeter, which can be of special service to railway engineers in the speedy estimation of the weights of worn rails, from outlines derived from "rubbings" of their ends. In contrast with the conventional type of planimeter it is simplicity itself, and a highly serviceable specimen was made by the writer, with the help of scrap materials, for a total outlay of one penny.

It consists of a 16-in. length of stout fencing wire, the ends of which are bent at right-angles to form three sides of a rectangle 12 in. by 2 in. One extremity is ground to a tracing stylus and the other to a miniature hatchet, the blade of which should lie in the plane of the instrument. The hatchet end of the rod should be weighted slightly and a convenient way is to let it transfix the base of a thimble, which can then be filled with solder. This planimeter is used in much the same way as the Amsler, the only important differences being that the tracing stylus should begin and end near the estimated position of the centre of area of the figure, and before and after the operation the hatchet should be pressed into the paper just firmly enough to leave a dent. The distance between the dents, multiplied by the "span" of the planimeter—from hatchet to tracing stylus—gives the area of the figure circumscribed. It is a wise precaution to repeat the tracing in the reverse direction, which should return the hatchet to its initial position. In practice these dents will rarely coincide precisely, and a point mid-way between them may be taken as correct.

For the special purpose of estimating the weights of worn rails a scale may be graduated to read lb. per yd. for measuring the distance between the dents in the paper made by the hatchet, and in this way surprisingly consistent results can be obtained.

Those who are interested will find the hatchet planimeter more fully described in the article on "Calculating Machines" in the "Encyclopædia Britannica," and there is also a reference to it in Whitelaw's "Surveying."

Yours faithfully,
E. T. HUTT

A Unified Colonial Railway Service

August 10

To the Editor of the Railway Gazette

Sir,—I have been interested in the two criticisims in The Railway Gazette of the article advocating a closer degree of Colonial railway unification.

Your second contributor, in the issue for July 18, is tilting at a windmill. Surely the object of the "grouping in accordance with size" was to enable a set of salary scales to be formulated which would ensure that officers serving on railways of equivalent size would have an equal opportunity of *promotion on increased salary* to one of a larger group. It was neither suggested nor intended that the groups as such should be identically administered, or that the railways within each group should be. The proposal was that the same degree of unification should prevail as in the other Colonial departments and the same opportunities for inter-promotion. No less an authority than the Attorney General of Australia has since suggested that such independent entities as the Dominions should adopt parallel policies through the medium of the air, and wireless conferences.

I was interested to read from your contributor in your issue of May 13 that Colonial railway officers learn the native languages and study native customs. My experience is that they leave both activities to officers of the Administrative Service! Pidgin English plus a smattering of patois is the general rule.

Yours faithfully,
COLONIAL RAILWAY OFFICER

[Articles debating this subject have appeared in our issues of May 13, July 15, and August 5.—Ed. *R.G.*]

PUBLICATIONS RECEIVED

A Survey of Railway Development and Practice. By P. E. Garbutt. London: Arthur H. Stockwell Limited, 29, Ludgate Hill, E.C.4. 7½ in. × 5 in. 112 pages. Price 3s. 6d. net.—This little book is presumably designed as an introduction to a more detailed study of railway operation, and as such is quite sound. It begins with a chapter on the origin and organisation of railways, in which is traced development from the opening of the Liverpool & Manchester Railway in 1830—the first public railway to use steam locomotion exclusively—and outlines the way in which early railways were promoted and built in various parts of the world. Rates and the conduct of traffic constitute the subjects of chapter II, and the fact that this involves only 14 pages sufficiently indicates that the treatment is but a general introduction to the subject. In turn, financial progress and modern railway development in many countries are treated, and the final chapter outlines the modern use of electric and diesel traction. The book is accurately described on the dust jacket as "A historical sketch of the progress of railways throughout the world, of the general principles governing their administration, and of their attitude to current transport problems."

A Manual of Foundry Practice. By J. Laing and R. T. Rolfe. London: Chapman & Hall Limited, 11, Henrietta Street, Covent Garden, W.C.2. 8¾ in. × 5½ in. × 1¼ in. 312 pp. Illustrated. Price 18s. 0d. net.—This is the second edition of one of the most authoritative works yet published on foundry practice, in the preparation of which a foundry superintendent and a metallurgist have collaborated. It deals with a subject of very wide application, for almost every branch of the engineering industry, including as a matter of course the engineering departments of railway organisation, is concerned with the use of castings in one form or another. The founder's art as practised in modern times has reached a very high standard of perfection, and the most intricate castings are now produced in various metals with the same, and indeed, an increased degree of accuracy compared with the simpler forms of earlier days. New methods have achieved considerable improvements in pattern making, moulding, and casting, and these have resulted in larger outputs accompanied by material economy in time.

The work before us deals fully with all phases of the foundry subjects, namely, core-making, moulding technique, loam, plate and machine moulding, the metallurgy and melting of cast iron, special methods of production and so forth; the bulk of the matter is concerned, owing to the importance of the subject, with ferrous castings. The final chapter is, however, devoted exclusively to non-ferrous founding, and there is a short appendix dealing with contraction of castings.

Numerous half-tone illustrations and drawings accompany the text, which is itself printed in a bold and clear type. The work can be recommended with confidence to everyone interested in the subject with which it deals, and particularly to those who are actually concerned with the conduct of the foundry.

Justicia para los Ferrocarriles. (Justice for the Railways.)—This small pamphlet in the Spanish language is issued by the Publicity Department of the Mexican National Railways, to justify the action of the railway administration in proposing an increase in the tariffs on mineral ores, against which, it appears, the mining companies have protested. The reasons for the increase now published are supported by statistics and diagrams, the intention of which seems to be to prove that the tariffs hitherto charged are much below the actual cost of transportation, with the result that other commodities have been overcharged and the railway service has been worked at a loss.

Telegraph and Telephone Lines.—We have received from British Insulated Cables Limited, of Prescot, Lancs., an illustrated catalogue of materials for the erection of overhead telegraph and telephone lines. Beginning with wood poles, the catalogue proceeds through iron and riveted steel types, with associated accessories, to numerous patterns of insulators and terminals. The final sections deal with line wire and jointing methods, including a clearly-illustrated description of jointing and binding procedure. Materials and advice for the erection of overhead communication lines under widely varying conditions will be found in the profusely illustrated pages of this catalogue.

Roller-Bearings for Railway Stock.—A loose-leaf brochure from the Fischer Bearings Co. Ltd., Wolverhampton, contains numerous illustrations of railway engines, vehicles, and street tramcars, to which the company's bearings have been applied. An introduction points out the importance of the roller-bearing in solving the problem of securing the maximum output with the minimum expenditure of energy. Another advantage is that roller-bearings require their lubricant to be renewed only once a year, so that the cost of lubrication and attendance is reduced to about one-tenth of that involved with plain bearings. One example is illustrated in the catalogue of an express locomotive with roller-bearings on all axles of engine and tender, namely, the streamlined 4-6-4 of the German State Railway. Other illustrations show a Pacific of the same railway with a roller-bearing tender, and another express type with roller-bearings for the connecting rods and return crank of the Walschaerts valve gear. In the rolling stock section railcars and high-speed electric, diesel-electric, or diesel trains are the most numerous types represented, but some ordinary main-line stock of the Roumanian State Railways is also shown. Among the goods vehicles illustrated are various high-capacity and special purpose types.

Blowing and Ventilating Fans.—A revised issue of Catalogue V.97, issued by Keith Blackman Limited, 27, Farringdon Avenue, London, E.C.4, shows a range of electric blowing fans for separate installation or combined with smiths' hearths. A portable forge is also illustrated, in which the fan may be either electrically driven or turned by hand through gearing. The Keith Blackman fans shown are suitable for the many industrial processes requiring a continuous service of air at pressures from 4-in. wire gauge up to 28-in. wire gauge. They are powered by a.c. or d.c. motors. We have also received from the same firm a folder giving a general survey of Keith Blackman ventilating fans, gilled tube heaters, and air filters, suitable for all heating or ventilating purposes on large premises.

An Electric Tenoner.—An illustrated folder from Thomas Robinson & Son Ltd., Railway Works, Rochdale, shows special features of an electric tenoner capable of cutting single tenons up to 6 in. long and double tenons up to 5 in., taking timber up to 24 in. wide by 6 in. deep. Control of the driving motors is by built-in push-buttons and contactor starters. Robust construction of the cutter-heads is a feature to which attention is particularly drawn, as also the adjustment of the scribing heads in conjunction with, or independently of, their respective tenoning heads. Locking devices secure all heads in position when set. Power comes from 4-h.p. enclosed motors for the top and bottom tenoning spindles, and for heavy bottom scribing or double-tenoning. The top and bottom scribing and cross-cutting spindles are powered by 1¾-h.p. motors.

"City of a Thousand Trades."—A strikingly produced booklet has reached us from the City of Birmingham Information Bureau, which has been issued with the object of furthering knowledge of Birmingham industries. In a centre which claims to be the home of 1,500 trades, ranging in type from heavy engineering to the delicacy of the jeweller's art, the task of compiling a handbook aimed to illustrate their variety is no light one. The end has been achieved by photography, following, as the booklet observes, the clear and intimate example of the cinema, and within its 28 pages over 250 illustrations have been compressed. The end papers have been used to display a fine aerial view of Birmingham, embracing the city centre and reaching to its northern limits eight miles away. Upon the cover, the smith at his forge, symbolic of the beginnings of Birmingham industry, stands silhouetted against the modern buildings of "England's Second City."

THE SCRAP HEAP

TOO LOUD FOR THE DEAF

Three deaf and dumb persons tried by means of signs to indicate to officials at Southend railway station the other day that the loud-speakers announcing trains were making too much noise. The noise, they complained, caused a vibration which hurt their ears.

* * *

Day excursions in the early days of the Taff Vale Railway were not always pleasant picnics. The "puddlers" in drink were a difficult lot to manage, and stationmasters, we are told, always had a pair of handcuffs ready for emergency.—*From the "Western Mail."*

* * *

Andrew Kernander, a car cleaner on the Boston & Maine Railroad, U.S.A., has made a model of one of the company's locomotives out of 3,472 matchsticks.

* * *

TRAIN STAFF LOST

The loss of the "staff" from a special train from Ballyhaunis to Claremorris on August 4 resulted in a partial dislocation of the service between those stations. The Dublin mail, reaching Ballyhaunis at 11.30 p.m., was held up till one o'clock on the following morning awaiting the arrival of a pilot engine from Claremorris. The missing staff was found almost midway between Ballyhaunis and Claremorris.

* * *

RAILWAY MILLENNIUM IN MEXICO

The Mexican National Railways have been taken over by the railway unions. On the face of it, maybe some railroad investors in this country would be glad to turn over their properties to the unions under similar conditions—because the Mexican Government, as owner, gets compensation in a fixed percentage of the gross revenue, and the union-management is prohibited from running up the operating ratio over 85 per cent. That is to say, in Mexico it appears that the railway owner is to get his share under any and all conditions.—*From the "Railway Age."*

* * *

Mr. William Lawton, who has retired from his duties as a train porter at Montreal, slightly reduces an allied family representation of 14 members, 12 of whom are train porters, in the employ of the Canadian National Railways. Another distinction of the families who go to make up this related group, is that all the men are bilingual. Thus Lawton senior, his sons, sons-in-law, and nephews are in frequent demand for service on special trains where a knowledge of two languages is a consideration. It is on record that on one occasion a special train operating from Montreal to the West was manned entirely with members of these families.

A sparrow has nested inside the platform bell at Pokesdown station, Southern Railway, and has reared a considerable family there. As the clapper strikes the outside of the bell, there is no detriment to its working, and, the birds being undisturbed by the noise, the arrangement appears satisfactory to all concerned.

* * *

40 YEARS OF THE BUDE BRANCH

Commenting on the opening of the Bude branch of the London & South Western Railway on August 10, 1898, the *Launceston Weekly News* of August 13 of that year said: "As it [the opening train] steamed in fog signals were discharged and rockets hissed into the air. The approaches to the station were packed by an immense crowd, and cheer after cheer went up from thousands of throats as 'one and all' realised that at last Bude was placed in direct touch with the outer world."

* * *

A piece of coal falling from the tender of an express train, as it ran through Levenshulme (Manchester) station recently, struck a group of three men standing on the platform. Their injuries were sufficiently serious to necessitate hospital treatment, after which they were allowed to go home.

TRAINS LEAVE EUSTON STATION

AS BELOW, FOR

Birmingham.		Liverpool and Manchester.		Preston and Lancaster.		Leicester and Nottingham.	
MORNING.	AFTERNOON.	MORNING.	AFTERNOON.	MORNING	AFTERNOON.	MORNING.	AFTERNOON.
6	—	*8¾	8½	*8¾	8½	6	5
7	2	9¾		9¾		9¼	9
8	5	11				11	
8¾	8½						
9¾							
11							
ON SUNDAYS.		ON SUNDAYS.		ON SUNDAYS.		ON SUNDAYS.	
8	8½	9¾	8½	9¾	8½	8	9
9¾							

Derby.		Sheffield.		Leeds.		York.	
MORNING.	AFTERNOON.	MORNING.	AFTERNOON.	MORNING.	AFTERNOON.	MORNING.	AFTERNOON.
6	—	6	9	6	9	6	9
—	2	—		—		—	
9¼	5	9¼		9¼		9¼	
11	9	11		11			
ON SUNDAYS.		ON SUNDAYS.		ON SUNDAYS.		ON SUNDAYS.	
8	9	8	9	8	9	8	9

Hull.		Aylesbury.	
MORNING.	AFTERNOON.	MORNING.	AFTERNOON.
9¼	9	8	3
		—	6
ON SUNDAYS.		ON SUNDAYS.	
	9	8	6

OMNIBUSES TO MEET THE ABOVE TRAINS,

LEAVE THE		Departure of Trains.
SPREAD EAGLE, Gracechurch Street CROSS KEYS, Wood Street, Cheapside SWAN-TWO-NECKS, Lad Lane	45 Minutes before the Departure of each Train.	6 A.M. 7 ,, 8 ,, 8¾ ,, 9¼ ,, 9¾ ,, 11 ,, 2 P.M.
GEORGE & BLUE BOAR, Holborn.	30 ditto ..... ditto	3 ,,
GOLDEN CROSS, Charing Cross.....	45 ditto ..... ditto	5 ,,
SPREAD EAGLE, Regent Circus	40 ditto ..... ditto	6 ,,
GRIFFIN'S GREEN MAN & STILL, Oxford-Street	30 ditto ..... ditto	8½ ,, 9 ,,

* None but Passengers riding in Private Carriages are booked through by this Train to Liverpool, Manchester, Preston, or Lancaster.

Reverse side of an official timetable of the London & Birmingham Railway dated June 1, 1841. The obverse was reproduced on page 1155 of our issue of June 17 last

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Postal Facilities on B.B. & C.I.R. Trains

In future special souvenir notepaper, envelopes, and stamps will be procurable from conductors on the Frontier Mail and Flying Ranee trains of the Bombay, Baroda & Central India Railway, and passengers will be able to post their letters in the train *en route*.

E.B.R. Bazar Special and Commercial Tour Trains

The Puja Bazar special has come to be regarded as an annual feature on the Eastern Bengal Railway, and there seems to be little doubt that the accommodation provided in the special train will be fully engaged again this year. In addition, the administration has decided to run a special train on a 22-day commercial tour of Bengal and those parts of Bihar and Assam served by the E.B.R. The object of the tour will be the creation of fresh markets and the renewal of trade relationships existing between Calcutta firms and up-country traders and business houses. The tour will embrace 20 important stations on both the broad and metre gauge sections and a total distance of 1,750 miles will be covered. A sufficiently long halt will be allowed at each station for the transaction of business during daylight. The railway, which is undertaking the advertising of the train prior to its arrival at various stops, will also distribute any handbills or other literature that firms may wish to send out beforehand at the pre-arranged halts.

Frontier Railway News

Made possible by the building of the Kalabagh bridge over the Indus [described and illustrated in our constituent and former associated contemporary *The Railway Engineer* in the issues of March and April, 1934.—Ed. *R.G.*] the scheme for transferring the 2-ft. 6-in. gauge locomotive depot from Kalabagh on the right, to Mari Indus on the left bank of the river, at a cost of Rs. 1,87,000 has been sanctioned and the work is in hand. This enables a combined broad and narrow gauge depot to be established, but to obviate the necessity for building new quarters for the ground staff, workmen's trains will be run twice daily across the bridge so that this staff may still be housed at Kalabagh.

The Risks of War

Frontier tribesmen attempted to blow up the Khoraba bridge on the Kalabagh—Bannu 2-ft. 6-in. gauge section of the N.W.R., early this month. The pier was cracked and girders damaged; also some 60 yd. of track were displaced and 85 sleepers partly burnt. Temporary repairs were effected by the Sappers and Miners (military engineers). [See also page 341.—Ed. *R.G.*]

All trains on this section run with two goods wagons in front of the engines, with the idea of exploding any bombs that may be placed on the track, without undue harm to the locomotive.

SWITZERLAND

Miscellaneous Items

The Federal Railways have introduced small containers with capacities of 1 and 2 cu. m., for loads up to 1,000 kg., which are available for hire to shippers for door-to-door traffic.

The range of zone season-tickets, referred to in The Railway Gazette of May 20, has been increased by the introduction of holiday tickets for the Neuchâtel, Bienne, Zurich, and Zug districts.

A company has been formed at Grindelwald for the construction of a mountain railway to Finst, with a view to opening up the ski-ing and excursion districts in the Faulhorn and Grosse Scheidegg directions.

The Basle Rhine Ports

The recent arrival at Basle of the *Karlsruhe X*, stated to be the largest river freight steamer in Europe, has drawn attention to the importance of Basle as an inland port. During 1937, nearly 3 million tons were handled at it, an increase of some 30 per cent. over the previous year; a considerable proportion of this traffic is distributed throughout Switzerland by rail. The present quays and port installations are at St. Johann, with rail connection from the station of that name, and at Kleinhüningen, on the opposite bank of the Rhine, where a large basin exists and a second is under construction, with modern warehouses and silos and some 25 km. of sidings. The Kleinhüningen port is connected by a short branch line with the Reichsbahn station. [See map below.—Ed. *R.G.*]

In view of the ever-increasing traffic, a new port is now being built at Birsfelden, on the Swiss bank above Basle, and is expected to be completed next year. A portion of the Basle aerodrome will be used, and a new airport is being made to the west of the city.

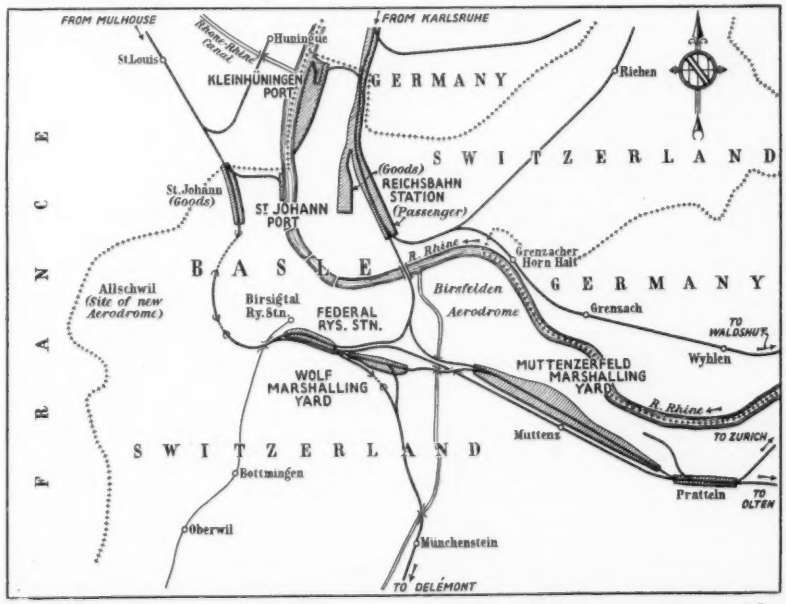
The Basle ports are worked by a joint administration of the Swiss Federal Railways and the Canton of Basle, and the following comparative figures show their recent development and the volume of traffic dealt with :—

	1936	1937
Number of ships arrived	7,000	7,861
Percentage of freight forwarded to other Swiss points	88%	87%
Number of wagons despatched from the ports	131,000	157,000
Chief categories of freight :—		
Coal and coke ...	1,131,000	1,437,000
Corn and fodder ...	468,000	568,000
Liquid fuel (petrol, &c.)	225,000	252,000
Foodstuffs	110,000	156,000
Chemical substances...	81,000	57,000
Iron and other metals	38,000	65,000
Length of quays ...	... 2·1 km.	
,, railway tracks	... 34 km.	
Total capacity of warehouses and silos	58,000 tons	
Total capacity of storage tanks	65 million litres (approx.)	

SPAIN

Merida Railway Reopened

The railway line from Merida to Don Benito was formally reopened on August 2, when a special train carrying civil and military officials made the journey to Don Benito. The reopening has been made possible by the reconstruction of the bridge destroyed



Sketch map showing the Rhine ports at Basle and their connections with the various lines of railway

by the Republican army. The Merida —Don Benito section is 53 km. in length, and forms a portion of the Madrid—Badajoz through line to Portugal. A further section of the line, as far as Castuera was opened to traffic on August 8. Castuera is 44 km. from Don Benito. in the direction of Almorchon Junction.

A New Railway Commission

The Burgos *Boletin Oficial* of July 22 publishes an order of the Ministry of Public Works dated July 9, authorising the appointment of a commission to study and report on the position of the railways in its technical, economic, and commercial aspects, the possibilities of a consortium of the companies with the State, the future development of the system, and the bases for a plan of betterments and extensions. The co-ordination of the railway and road transport will also be considered. The commission will consist of a president and nine other members. The president will be the chief of the National Railway Department, with two engineers of the same department as members, also an engineer of the Roads Co-ordination Office, a representative of the Military Railway Department, a delegate from each of the Ministries of Finance, and Industry, and Commerce, and finally, two financial experts and a legal assessor nominated by the Ministry of Finance. It will be observed that the commission is to be composed wholly of Government officials, and presided over by the head of the Railway Department. Neither the railway companies nor road interests are directly represented. If the past history of government intervention in the railway question be remembered, this may, perhaps, not be considered a defect. On the other hand it is noteworthy that no fewer than four of the members of the commission are to be nominated by the Minister of Finance, and this may be some indication of the views of the Burgos Government towards this long-standing problem. While the railways in Republican Spain have been nationalised and are worked by a National Railway Council, those in Nationalist territory are still being operated under the terms of their original concessions, modified in some cases by the Statute of 1924.

Family Allowances

The Burgos *Boletin Oficial* of July 19 publishes a Decree approved by the Council of Ministers on July 16, establishing a compulsory system of family allowances, on a contributory basis. The allowance will amount to 15 pesetas (7s. 3d.) a month for 2 children, on a scale rising to 145 pesetas (£3 9s. 0d.) a month for 12 children, and will be paid by the State from a fund supported by contributions from workers, employers, and the State. This is not altogether a new thing in Spain, as at least one of the principal railway companies (the Madrid Saragossa and Alicante) for many years paid its lower rated employees a family allowance for each child, without any contribution from the employee.

SWEDEN

New All-steel Sleeping Cars

The Swedish State Railways have just taken delivery of five new all-steel sleeping cars for the Swedish-German through services. Another five are under construction and a third group of five will be built next year. Three of the five which went into service on July 29 were built by Kockum's Engineering Works of Malmö, and the other two were turned out by the State Railway workshops at Linköping. Apart from King Gustav's private saloon, the new cars are the first Swedish sleepers equipped with hot and cold running water in every compartment. The system for heating the water and the carriages themselves is of a dual type, electrical when in Sweden and steam while on German rails.

The new cars have special braking equipment and other facilities to permit their operation at speeds up to 130 km.p.h. in Germany. Such provision is not necessary in Sweden, where the maximum legal speed is 90 km.p.h., though the Swedish State Railways are now embarked on a long-term programme of re-ballasting and curve realignment to permit of speeds up to 120 km.p.h.

Designed by Baron C. A. von Köhler of the State Railways' Engineering Department, the new carriages have seven compartments for first or second class passengers and five for third class. Thus they can accommodate alternatively seven first or fourteen second class passengers and fifteen third class. The first and second class compartments are finished in teak and the third class in oak.

When the second group of five cars is completed, three will run in the Stockholm-Berlin service, three on the Stockholm-Hamburg line, and three in the Oslo-Germany service, with the tenth car as a stand-by. As the sleeping cars of the Norwegian State Railways are not suitable for service in Germany, the agreement is that their sleepers are kept in service between Oslo and Sweden, and the Swedish State Railways supply cars for the through service from Oslo across Sweden and into Germany.

CHINA

Collision on the Canton-Kowloon Railway

On July 14 a collision occurred on the Canton—Kowloon Railway between a goods train, carrying munitions from Hong Kong for the Chinese forces, and a passenger train from Shumchun. The accident took place at 4.20 p.m., and resulted in injuries to seven persons and considerable damage to rolling stock, which threatened to interrupt traffic for several days. Luckily few passengers were travelling by the train concerned, as the destruction of the coaches showed that otherwise casualties would have been very heavy.

More Military Demolition

The Chinese are reported to have destroyed one-third of the formation of the Hwainan Railway, which connects the Yangtse port opposite Wuhu with northern Anhwei. Wide trenches have been dug out of the embankments and all rails have been removed and dumped in the fields nearby. The sleepers have been used for firewood. The Javanese engineers are now busy repairing the line.

Demand for Traffic Facilities in Occupied Zone

The Governments of Kiangsu and Chekiang Provinces as reorganised under Javanese auspices are urging the Japanese army to provide strong guards against sabotage and guerilla attacks, and also adequate goods stock, so that freight traffic may be resumed in those Provinces to hasten a revival of commerce and industry. At present only passenger traffic is being worked, and, due to the great demand for tickets, some passengers are said to be having to wait 10 days to secure accommodation on the trains.

Railway Administration at Peiping

The railway administration centred upon Peiping as now reorganised has seven departments, all in charge of Japanese officers. The sole remaining Chinese in any high position is in charge of a sub-department.

It is reported that this administration has renamed the principal railways it controls as follows:—

Old Name	*New Name*
Peiping-Shanhaikwan section of the Peiping-Mukden Railway	Kinshan
Peiping Suiyuan Railway to Paotou	Kinpao
Tungchow—Kupeikow Pass newly-constructed line	Kinku

Presumably the new names take the final syllable of the city from which these lines radiate—Pekin (Chinese Peiping) and add the initial syllable of the further terminus. Several stations have also been renamed.

Reopening of the T.-P.R. Yellow River Bridge

The 4,000 ft. Yellow River bridge on the Tientsin—Pukow Railway near Tsinan, capital of Shantung Province, which has been under repair by South Manchuria Railway engineers for the past five months, was reopened for traffic on July 1. The bridge was partly destroyed by the retreating Chinese forces. This should enable through traffic to be resumed between Peiping and Pukow (Nanking) *via* Tientsin and Hsuchow, but probably only for military purposes.

CRANES FOR RAILWAY PURPOSES—I

A review of modern practical load-handling methods

By J. DALZIEL, late Assistant Electrical Engineer, L.M.S.R.

THE following notes relating mainly to cranes deal with points that have arisen from time to time in the writer's experience. It is hoped they may be of some interest. It is to be understood that the views expressed are those of the writer individually.

Apart from shop cranes, crane installations mainly serve the traffic operating department. The governing factor in the selection of the requisite appliances should clearly be that of giving the most efficient service to the using department. This latter is a varying criterion; for a wayside or other crane infrequently used the cheapest will in general be the best appliance. As the part played by the cranes in general operating economy increases in importance, so the importance of speed and facility of operation becomes enhanced, culminating in the case of quayside cranes where, more than in any other case, the working speed and convenience of operation of the cranes set the pace as regards the efficiency, service reliability and reputation of the port.

In particular relation to such installations as these last, a factor is that for every movement of a crane under load there must be a corresponding unloaded one during the period of which the staff are partially inactive. Accordingly it is important to speed up empty movement time to the utmost possible extent.

It is assumed that readers are familiar with the various types of railway crane and their respective general designations and purposes. The walking jib crane may not be familiar; it is a portable jib crane running on a single rail and held vertically by rollers engaging with another rail overhead.

Comparison of Hydraulic and Electric Power

As regards driving power, for cranes having to work anywhere up and down a yard or on the line generally, obviously steam or internal combustion drives only are available. For important fixed installations of multi-movement cranes neither steam nor internal combustion cranes are fast enough or handy enough in operation, and hydraulic or electric operation is universal. Of these electric preponderates. Energy for energy the general trend of costs has been increasingly favourable to electricity. Of recent years its widespread use, its centralisation of production, its ease of distribution and its general availability on terms and conditions favourable to the consumer, have emphasised the discrepancy of cost in its favour; so much is this so that many hydraulic installations have been converted to electric pumping; in these circumstances the hydraulic cost obviously starts on an energy for energy basis 50 per cent. or so in excess of the electric. As 1,000 gallons of pressure water at 750 lb. per sq. in. is equivalent to about 6½ kWh., to correspond with electricity at ¾d. a unit, the hydraulic cost must not exceed about 5d. per 1,000, or about half the cost generally attained.

Electric apparatus is flexible and easy in its application, and is highly efficient throughout a wide range of loads; apart from press work in the shops, and the like, hydraulic operation is pre-eminently suited to one type of plant only, viz., coal hoists, and some other types of machines driven by it are inherently the most wasteful of driving power in use by railways.

For any new crane installation accordingly it would appear that only electricity could reasonably be considered. It may be argued that extensions of an installation hitherto hydraulic, or new substituted for old hydraulic cranes, should be hydraulic, especially where pumping has to continue for other plant. But the foregoing, and the figures below, show that the really logical course in all such cases is that which envisages the final elimination of hydraulic plant altogether, so unifying the machinery in use and its maintenance, and wiping out hydraulic pumping and its cost.

Even coal hoists can be so dealt with; electrically operated coal hoists of the hydraulic pattern exist, but the electric coaling plant of the future is more likely to be the conveyor as better adapted to rotary motion, taking its power with a less exacting and "peaky" demand, and being moreover a better coaling appliance.

Neither the hydraulic nor the electric crane has any inherent service superiority over the other. Both can be made to give within reason any desired speed of movement; and the full load efficiency of both may be about the same, say 70 per cent. Against the wide-range economy of the electric motor, however, the hydraulic crane must have rams providing for any required overload and for acceleration and friction, and takes this same ram power and water for any lower load including the empty hook.

As the average load on a general cargo crane is about 5 to 10 cwts., or say ⅕ of the crane's rated load, and the electric crane will lift this with about ¼ full load power, on the day's work for load and empty hook lifting the energy consumption of the hydraulic will be about six times that of the electric crane. For the other motions the respective consumptions are more alike, but hydraulic consumption over all may be put as three times electric for the same work on general cargo, which means about six times in cost.

A.C. or D.C. Power

There are variations in the method of application of electric power. Current supply is almost universally 3-phase, a.c., and in this form can be and is applied satisfactorily to crane operation in very many cases. It has the outstanding defect, however, for crane working that the ordinary 3-phase motor lifts light loads and the empty hook at practically the same rate at full load. Even on a prevailingly full load crane, such as say a grabbing crane, the slow empty hook speed is detrimental and on general cargo the resulting slowing down is serious. A further defect is that, contrary to d.c., where motor torque increases faster than current, torque varies only directly as the current, resulting in high starting current, low starting efficiency, enhanced maximum demand and increased cost of current.

In the interests of efficient traffic service, full load rated lifting speed should be raised, even though not used for the heavier loads, to improve lighter load speeds. This involves motors of higher horsepower, further loss of efficiency on heavy loads, and still higher maximum demand. For all important installations, therefore, particularly on quay sides where working speed is vital, d.c. operation should be adopted as producing cranes of superior operating efficiency and faster in working than a.c. If the motor characteristic is properly specified, the

empty hook speed of a d.c. lifting motor should be three times, and ¼ load speed twice, full load speed. With modern rectifier methods it is both cheap and easy and entirely justifiable to convert the requisite current, and the loss in such conversion will be more than counterbalanced by the higher efficiency and lower maximum demand of the installation.

A.c. control gear is also more complicated and expensive than d.c. as there is more of it because of the separate stator and rotor circuits, and solenoids, etc., are also less simple. Apart from the d.c. crane being the better tool, the cost of an a.c. installation of any appreciable number of cranes is therefore likely to be as high as that of the corresponding d.c. installation including the sub-station cost; it will be more costly in current, and give inferior working results.

Method of Application of Power

Slip ring motors are most suitable for a.c. crane work; the high resistance squirrel cage rotor type has been suggested, but so far as the writer is aware never adopted for quay side cranes. Their use might simplify control gear but at the expense of more jerky starting, and they would heavily increase starting current. A.c. variable speed motors or series motors of the single phase traction type would be eminently suitable for crane work except for high cost; they have not been applied so far as the writer is aware in this country.

On very heavy cranes using a.c., *e.g.*, coal-loading cranes, it is general to motorgenerate to variable voltage d.c., *i.e.*, on the Ward-Leonard principle for the higher powered motors of round about 200 h.p.; it would appear possible and perhaps advantageous to apply grid control rectifiers to this purpose. For shop cranes higher speed on light loads is less important than on quayside cranes, since the average lift is shorter and the travelling motion is much more frequently used and for longer ranges of movement. Of chief advantage in these cranes, however, is the better starting and smoother control of d.c. operation, and this is specially important in the erecting shop or other cranes where delicate adjustment or inching by means of the cranes is required.

Breakdown and Mobile Cranes

The breakdown crane is the outstanding railway steam crane. Shortly before the war the increasing weight of locomotives, setting up a need for correspondingly heavier breakdown cranes, led to the development of the " relieving bogie " design, by means of which, for travelling, the weight of the crane and its balance weights is distributed over a number of trucks, so lengthening the wheelbase and reducing as required the weight per foot run.

In goods department work the chief development of recent years is the supersession of other cranes by mobile cranes. These began as electric battery cranes but are now mainly petrol- or diesel-electric cranes. Their capacities are now up to at least 6 tons, and as they run on the road surfaces of the yards and on the shed decks and not on the rails, they have access to any wagon without requiring it to be shunted. They are sometimes fitted with caterpillar track carriages. They are naturally limited in jib rake because of wheelbase and counterbalance limitations, but not to an extent to handicap them seriously. Their use has much reduced shunting for cranage purposes and enabled traffic to be increasingly dealt with without having to come into the sheds at all, and has practically eliminated fixed shed deck cranes and their obstructive occupancy of deck spaces. Their use of electric transmission makes the full engine-power available on the load at all speeds; it would not of course be so with clutch transmission.

Internal combustion drive has not so far been used seriously for breakdown cranes. The writer has recollections of one such crane being built, but believes it was subsequently converted to steam; there is no weight saving, as boiler weight must be reproduced for balance purposes. Perhaps with still further increase of locomotive weight a breakdown crane may be devised of corresponding lifting capacity with the aid of diesel-electric drive and a further development of the relieving bogie idea.

Shop and Shed Cranes

The heaviest overhead travelling railway cranes are in the works erecting shops. These cranes are generally in pairs, or may have two crabs for lifting an engine or carriage bodily from each end; frequently they are arranged on a high level gantry with an independent gantry below on which runs a set of lighter travellers; this tends to mutual interference of movement between the two sets of cranes. The writer would suggest as a better alternative to the lighter set of cranes, especially when the gantries run lengthwise of the shop, the use of walking cranes working down the walls on each side and raking into the centre of the shop.

In goods sheds, overheads provide lifting capacity at any point necessary without taking up deck space, but with two or more over the same deck they may on occasion obstruct each other. They have the common failing that a crane sent away with a load may keep the staff waiting idle for a long time for its return, but they are mainly used for cross deck traffic. They are sometimes fitted with underhung jibs which may be slewing or simply extensible across, enabling them to deliver into the next adjacent bay; this is a convenience for isolated loads but obviously could not handle any great volume of goods across the shed economically. Incidentally these cranes can be and have been fitted to travel on curved tracks.

Goliath cranes are in general used in yards for heavy lifts up to 50 tons, or sometimes more. They are not suitable in themselves or in their environment, for high speed, and especially high travel speed. Where fast working is required overhead travellers on gantries should be installed. Wide-span Goliaths frequently have the two legs driven by individual motors with electric interlocking holding the motors to the same revolution speed. They are sometimes made with the overhead cross girders extending, and the crab travelling, beyond the legs, and this can be used to provide for delivering into a barge or ship from a quay. Where, on overhead travellers or Goliaths, auxiliary barrels for lighter loads are fitted, these should preferably be worked from their own individual motors. If they are worked through clutches, the friction type is preferable to and handier than the claw type, which is frequently fitted nevertheless.

In converting steam Goliaths or overheads, or fly rope shop cranes to electric, generally the original gantries, cross girders and end carriages can be retained, but a new crab is advisable. For such cranes a single shunt or compound wound motor working through clutches like a steam engine can be used, and the writer knows of one such Goliath crane with a friction drive which has been in use with little or no trouble for nearly 40 years; generally speaking, individual motor drive is preferable.

Shear-Legs and Wheel-Drops

There are a few cases of jib cranes in goods yards for heavy lifts, and such cranes are also so used in quayside work, but in general also and mainly for coal loading. The main quayside heavy lift appliance is the shear-legs. It has not fore and aft movement and is therefore clumsy, and it takes up a long length of quay face. It has, therefore, to be placed away from the main cargo handling berths. This entails the ship having to be moved to it when it has to be brought into use; this is costly

and in a busy service may entail loss of loading time that cannot be spared. There is room for the design of some new type of heavy loading quay face appliance that can be erected on the normal berthing spaces without obstructing the normal cargo handling appliances when it is not in use.

Locomotive lifting shear-legs are in extensive use, but are not suited as they exist for the large engines of recent years. A substitute giving higher lift for the same overall height is an overhead gantry with an electric lifting block; a much lighter modification of this, spanning both a track and a cartway, and with the block cross-traversing, would provide a very cheap form of goods yard appliance for occasional cranage. The most modern appliance for locomotive wheels is the wheel-drop whereby the pair of wheels is dropped underground instead of the engine being lifted from them. Electro-pneumatic or electro-hydraulic operation is the simplest for these; direct electric drive of the lifting and lower platform is possible; in this case a high resistance rotor motor should be used to permit of its being stalled in maintaining pressure on the springs when replacing pins. Both steam operated dock, and hand-operated locomotive lifting shear-legs, have been converted satisfactorily to electric operation.

SOME PROBLEMS OF THE NEW NETHERLANDS TIMETABLE

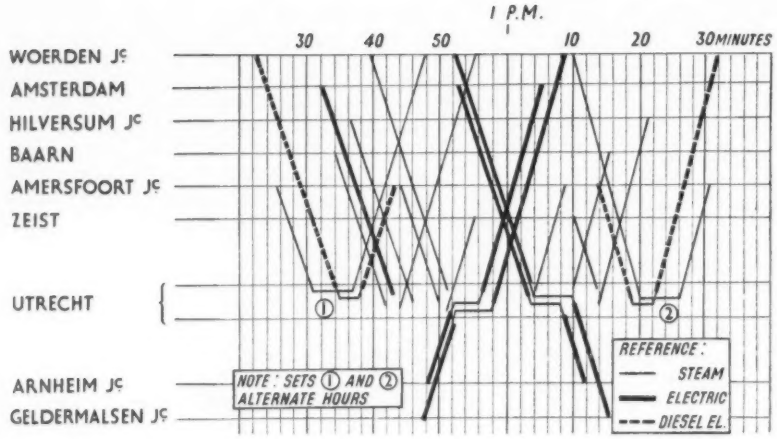
These involve provision to suit various forms of traction at varying maximum speeds, accelerations, and decelerations, and the inter-connection of all kinds of trains at a large number of important and minor junctions

THE preparation of the new Netherlands Railways standardised timetables, referred to briefly in our issue of April 15, and in greater detail in that of May 20, presented a number of intricate problems, some of them similar to those of our own Southern Railway and others possibly unique. The complications included the facts that (*a*) four different kinds of traction—steam, electric, diesel-electric trains, and railcars—with correspondingly different accelerations and speeds, as explained below—had to be provided for, over the same sections of line in some cases; (*b*) as the accompanying map shows, the system consists of a network of main lines interconnected at numerous closely spaced junctions, and a number of important cross-country lines, the whole serving not one but many railway centres of almost equal importance: consequently an extraordinary number of satisfactory connections between trains was demanded; (*c*) as many of the lines are single and such a large number of intermediate stations have now been closed to passenger traffic, train crossings were either limited to the few stations remaining open or to as few others as could possibly be arranged—this matter is more fully dealt with below—and (*d*) long-distance international expresses had to be considered. Thus, although hourly or half-hourly services were aimed at, it was found impossible to adhere rigidly to this principle, because of the complicated interlocking connections involved. The unusually drastic measure of making international expresses give way to local services has had to be taken, and in one instance an express is detained at a frontier station for 37 min. for this reason. Moreover, a rule is now in force that no train is allowed to wait for connections off late-running trains, except in the case of the last train in the day.

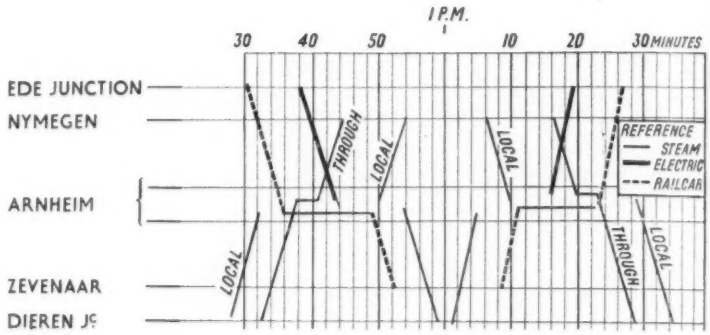
The four different kinds of traction mentioned above are the following:—

1. Steam trains are booked to maintain a normal running speed of 100 km.p.h. (62½ m.p.h.), and timetables are prepared on this basis, allowing, in the start to stop times 3 min. extra for acceleration after the stop and retardation to the stop. This applies to all steam trains run on electrified and on diesel and steam operated sections,

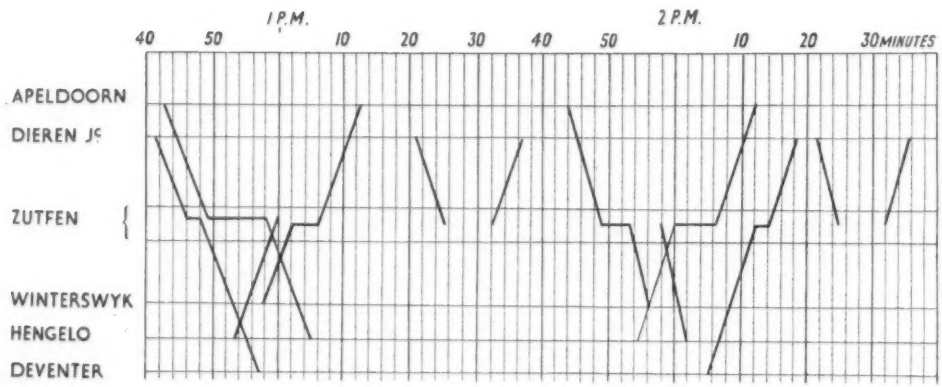
Sketch map showing steam, electric, and diesel services of the Netherlands Railways



Left: Fig. 1—Graph showing method adopted for providing connecting trains at hourly intervals in all directions at Utrecht, the principal centre of the system



Right: Fig. 2—Similar graph showing connections at Arnheim, an important provincial centre, and a junction between electrified and non-electrified sections



Left: Fig. 3—Showing connections at a less important junction, Zutfen, from which it is clear that in order to secure good connections at more important centres, those at such smaller junctions must suffer

but only 2 min. extra are allowed in start to stop times of trains run at a normal speed of 90 km.p.h. (56 m.p.h.) on cross-country main lines not electrified and on which no diesel-electric trains are run. Again, 1 min. extra is allowed to light stopping trains on secondary lines on which, by Government regulations, a speed limit of 65 km.p.h. (40 m.p.h.) is imposed.

2. Electric trains, composed of the new streamlined stock operated on the newly-electrified central lines, are run at a timetable speed between stops of 120 km.p.h. (75 m.p.h.). The electric trains run on the earlier electrified western lines, operated with the old non-streamlined stock, are limited to a normal running speed of 100 km.p.h. (62½ m.p.h.). Accelerations vary, but they have been calculated and tabulated as will be explained later.

3. Diesel-electric trains, with streamlined stock, run on long-distance services over routes partly electrified, partly steam operated. Their maximum speed is 120 km.p.h. (75 m.p.h.).

4. Diesel-electric streamlined railcars are run at a maximum speed of 90 km.p.h. (56 m.p.h.) on main lines, at a maximum of 75 km.p.h. (47 m.p.h.) on secondary lines, and 65 km.p.h. (40 m.p.h.) on lines on which this limit operates. The old low-speed petrol railcars, formerly run on certain light railways now closed, are now used on secondary lines in one particular district, round Zwolle. These will at some future date be scrapped and replaced by diesel-electric railcars.

All the electric and diesel-electric trains, and diesel-electric railcars have finely cut extra time allowance in start to stop timings for acceleration and stopping, calculated and tabulated for all speeds up to the maximum. The acceleration of the streamlined electric trains is from 160 per cent. (at low speed) to 80 per cent. (at max. speed) faster than that of streamlined diesel trains, but the retardation is equal. The old electric non-streamlined stock is appreciably slower in acceleration than the new stock, but still slightly faster than the streamlined diesel train;

retardation is slower than in the other cases. The acceleration of the streamlined diesel railcars is slower than that of the diesel trains, but retardation is again equal. Comparative figures are shown in the table hereunder:—

Additional time in start to stop timings, (*a*) for acceleration from a dead stop to the speed given; (*b*) for retardation from that speed to a dead stop; (*c*) total of the two, in min. and decimals of a min., for trains and railcars answering to the following descriptions:—

Abbreviations for Description of Train or Railcar

E. = Electric
D.-E. = Diesel-electric
Sl. = Streamlined
N.-Sl. = Non-streamlined
R. = Railcar
L.St. = Light steam
A.St. = Average steam

Description of train or railcar	Max. Speed m.p.h.	(*a*)	(*b*)	(*c*)	
E. Sl.	75	0·69	0·62	1·31	= 79 sec.
D.-E. Sl.	75	1·24	0·62	1·86	= 112 ,,
E. Sl.	62½	0·48	0·52	1·00	= 60 ,,
E. N.-Sl.	62½	0·80	0·64	1·44	= 86 ,,
D.-E. Sl.	62½	0·84	0·52	1·36	= 82 ,,
E. Sl.	56¼	0·41	0·48	0·89	= 53 ,,
E. N.-Sl.	56¼	0·62	0·58	1·20	= 72 ,,
D.-E. Sl.	56¼	0·70	0·48	1·18	= 71 ,,
D.-E.R. Sl. ..	56¼	1·36	0·48	1·84	= 110 ,,
L. St.	56¼	—	—	2·00	= 120 ,,
A. St.	56¼	—	—	3·00	= 180 ,,

The timetables for the single lines called for special attention, in connection with the necessity of finding suitable crossing timings. The closing of wayside stations for passenger traffic added a new factor to the problem. Stations closed for passenger traffic have, with few exceptions, been kept open for goods traffic, and existing crossing loops have been kept in service, but service stops for the crossing of passenger trains at stations closed for passenger traffic had to be avoided as far as possible, otherwise two of the principal motives for the closing of the stations would be defeated. The timetable section has been strongly in favour of the closing of intermediate stations on a large scale, its first argument being that this would afford an opportunity to eliminate slow all-stations trains, and run fast trains only to one standard schedule between junctions, without increasing the aggregate train-miles on the section. It was further argued that each train stop cost a certain amount of money, and that the passenger revenue of many wayside stations was below the aggregate cost of all train stops at these stations.

Another problem was to avoid serious increase in train mileage in the attainment of regular hourly services. This difficulty has been met to a large extent by the cancellation of the stopping trains. Also, wherever possible, advantage has been taken of the closing of the majority of intermediate stations to provide connections by the third side of a triangle of lines, and thus avoid congestion at the junction at the apex of the triangle. Actually, in framing the timetable for the whole system, Utrecht was considered the key point, and Fig. 1 shows graphically the method adopted for providing connecting trains in all directions at hourly intervals. Fig. 2 shows the same for an important provincial centre, incidentally a junction between electrified and non-electrified sections. Fig. 3 shows a less important junction, and here it is obvious that, in order to secure the best possible connections at the more important junctions, those at the smaller centres must suffer and be inferior.

Another point worthy of note is that the electric services on the western lines, run with the old stock, still carry three classes of passenger, as do all long-distance and cross-country steam trains. The new electric trains on the central section, the diesel-electric long-distance trains, and the diesel-electric railcars carry two classes, second and third only, as do most of the steam trains on branch lines.

MICROPHONE AMPLIFIER FOR SHUNTING

AT the North Melbourne (Victoria, Australia) gravitation yard signal box there has recently been installed an amplifier equipment, by which the signalman can issue his instructions to the shunting staff through two powerful loud-speakers. The method of operation is for him to press a button and speak into a microphone in the signal box, and the loud-speakers, mounted on a post in the yard, enable him to be heard by shunters working hundreds of yards away, in spite of this being a particularly busy and noisy centre of the yard. As well as relieving the signalman of the strain upon his voice, the equipment makes it unnecessary for the shunters to walk frequently to within a short distance of the box to receive instructions. At night time its value is emphasised, for as many as 59 goods trains arrive at the gravitation yard and are sorted throughout the marshalling grid to distances up to half a mile by gravity.

Extensions of Albert Stanley Institute.—A grant of £3,300 has been made by the board for alterations and extensions of the Albert Stanley Institute, the London Transport railway employees club in Great Church Lane, Hammersmith. The institute was founded for men of the District Railway by Lord Ashfield, when Mr. Albert Stanley, in 1914. The extensions include a large bar and a games room. The institute already has a concert hall seating 500, a billiards room, a library, and a lounge.

MACHINING A LOCOMOTIVE DETAIL

Milling and boring operations on roller-bearing rocker arms for valve motion of L.M.S.R. "Princess Coronation" locomotives

AS already stated when describing the streamlined locomotives for the Coronation Scot express of the London Midland & Scottish Railway, in THE RAILWAY GAZETTE of May 28, 1937, these engines have two sets of Walschaerts valve gear situated outside the frames, driving the outside piston valves direct, and the inside ones by means of rocking levers; the whole arrangement is specially designed to allow the removal of both sets of valves for examination, with the minimum amount of trouble.

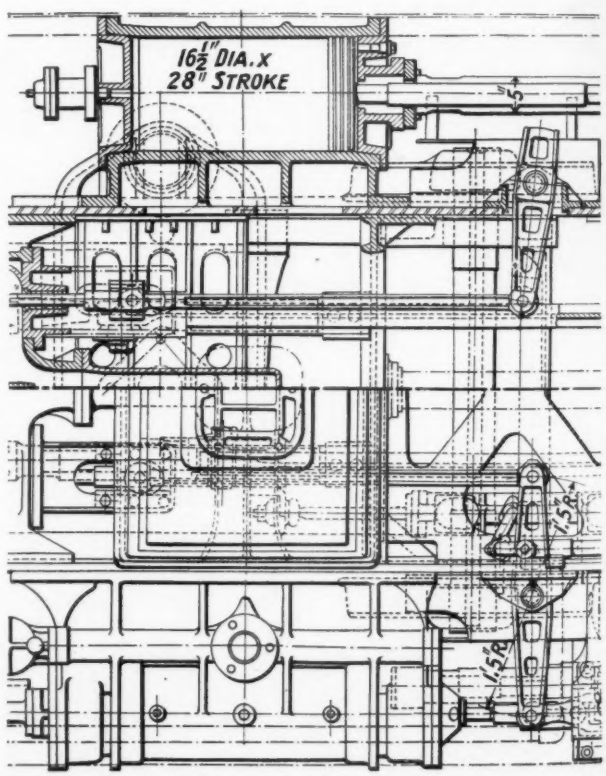
The rocking levers and other parts of the valve motion are fitted with needle roller-bearings, and the machining of these details covers milling, fluting and boring operations. By the courtesy of Mr. W. A. Stanier, the company's Chief Mechanical Engineer, we are able to reproduce photographs showing these operations in progress in the works at Crewe. The milling work is done on Kendall & Gent horizontal profile milling machines, and Fig. 1 shows the lever in the rough being milled to form prior to fluting, which latter may be regarded as the second stage. The form of the lever is controlled by a forming attachment; the cutters are 4 in. diameter by 10 in. long, and are of the high-speed steel, inserted-tooth type. The roughing cut is carried out at a speed of 34 r.p.m. with a feed of 0·75 in. per min., with a $\frac{3}{16}$ in. depth of cut, and finished at the same speed and feed with a $\frac{1}{16}$-in. depth of cut. The floor to floor times for this operation is 12 hr., and the amount of metal removed is 30 lb. Two of the components, one in the rough forged state, and the other completely machined ready for the fitting of the needle roller-bearings in the centre opening, can be seen in the foreground of Fig. 1, and as an indication of the amount of machining performed on the unit it may be stated that the weight of the forging is $2\frac{1}{2}$ cwt., while the lever when finally completed weights 85 lb..

Figs. 2 and 3 show the fluting operation, which is performed on two of the rocking levers at a time on each machine, the levers being mounted alongside one another. The maximum depth of the flutes is $1\frac{1}{2}$ in., and the roughing operation is carried out at a speed of 30 r.p.m., with a $\frac{1}{4}$-in. depth of cut and a feed of 0·75 in. per min.; the work is finally completed at a speed of 30 r.p.m. with a cut of 0·040 in. and an 0·75 in. per min. feed. Two high-speed solid cutters, 6 in. dia. by 2 in. wide, are used for this operation, during which both sides of the levers are fluted. The weight of the lever prior to machining is 1 cwt. 3 qr. 18 lb., and after machining it weighs 1 cwt. 1 qr. 13 lb., giving a reduction in weight of 61 lb. The floor-to-floor time for the complete operation is 30 hr. In Fig. 3 the former can be seen bolted to the side of the machine table. The head carries a roller, and this, in contact with the former, controls the shape of the flute.

The boring operation, *i.e.*, the boring of the centre hole in the rocking lever, is done on a Kearns boring machine. The centre hole is bored out to fine limits to accommodate the needle roller-bearings. The jaws of the lever are not in line, and it is therefore most essential that the centre hole should be bored centrally to the jaw pin holes; to ensure this being done, the lever is mounted on a special jig plate secured to the table, as seen in Fig. 4. Prior to machining, a 2-in. dia. hole is drilled in the centre of the lever, and four diameters ranging from 3·740 in. to 4·330 in. with limits of 0·0005 in. are bored through a depth of $4\frac{1}{4}$ in., the faces of the lever also being machined to a depth of $\frac{1}{16}$ in. by $5\frac{1}{8}$ in. to accommodate the glands. The roughing operation is performed at a speed of 100 r.p.m. with a $\frac{3}{16}$-in. depth of cut and a feed of 64 cuts per in., and finished at a speed of 46 r.p.m. with a 0·010 in. cut, and feed of 96 cuts per in. High-speed steel tools are used throughout, and the total floor-to-floor time for this operation is 18 hours.

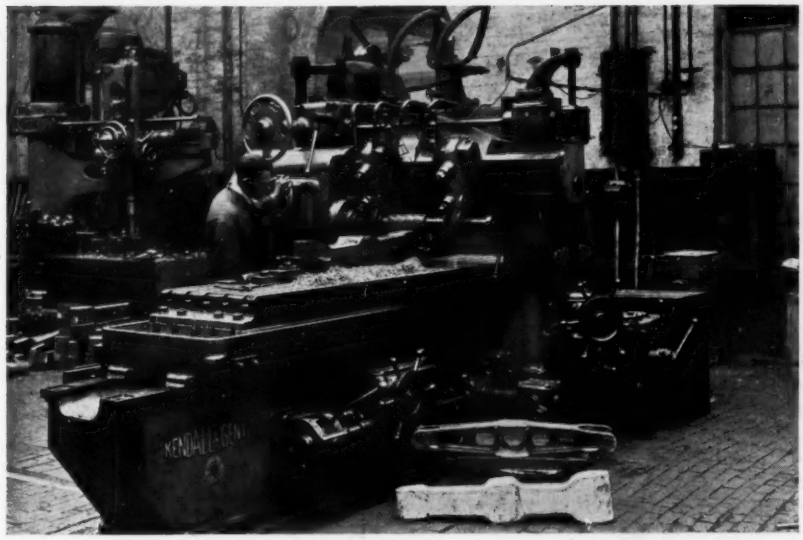
Reverting to the Kendall & Gent horizontal milling and profiling machines, these are of the latest standard pattern fitted with the maker's patented new design profiling motion to the cross slide carrying the milling cutters, an arrangement which enables work of irregular shapes to be machined in quantities at a time, to correct form, with the same facility as plain slab milling. The traversing motion to the table is by hand, and there is variable reversible power feed together with rapid traverse for setting purposes. An automatic stop motion is provided for stopping the table at any desired point; the driving motion is obtained from a constant-speed motor coupled to a change-speed box by a multi-vee rope belt. The machine is of substantial construction, with abundant rigidity for heavy work operations. The accuracy and rapidity with which the work was being performed, when, by Mr. Stanier's courtesy, we were enabled to watch these machining operations at Crewe, were very impressive.

The Kearns boring machine is of the maker's patent

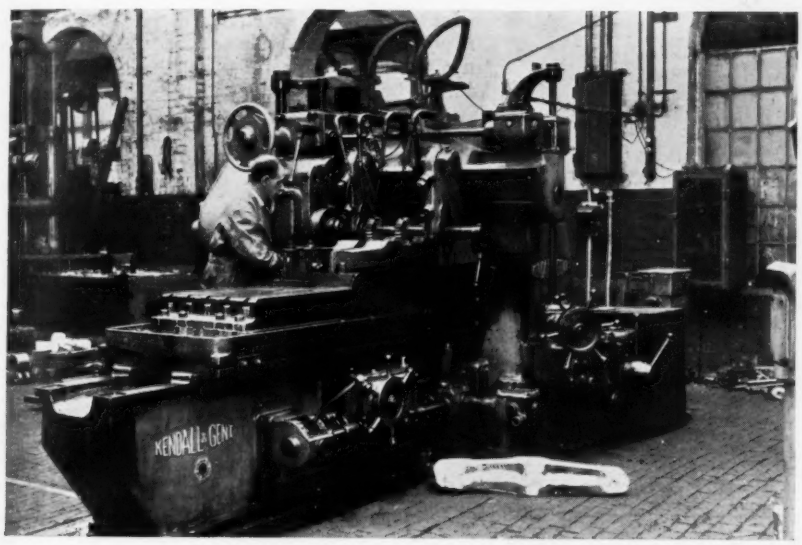


Part of locomotive chassis in plan, showing location of roller-bearing rocker arms of valve motion

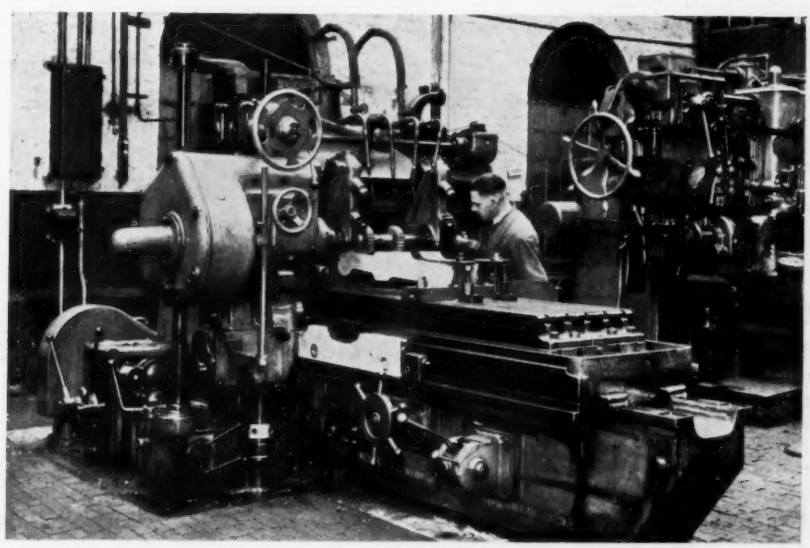
Machining a Locomotive Detail



Right: Fig. 1—First operation: milling rocking lever to shape on Kendall & Gent machine from rough forging



Left; Fig. 2—Fluting operation being performed on pair of rocking levers simultaneously



Right: Fig. 3—Fluting operation: showing former bolted to the side of machine table

Fig. 4—Boring centre hole of rocking lever on Kearns machine

Universal type, an outstanding feature of which is the combination of a travelling spindle of substantial diameter, with a self-contained automatic facing chuck. The travelling spindle can be revolved either simultaneously with, or independently of, the facing chuck; thus, for all drilling and tapping and the boring of relatively small diameter holes, it is not necessary to revolve the chuck. On the other hand, when both are revolved together, the machine is capable of boring and facing simultaneously. This again is a robust machine of its kind, and is equally adaptable to the purposes of surfacing, boring, milling, drilling, and tapping, thus affording a wide range of utility for locomotive shop requirements.

Progress on L.P.T.B. New Works

Almost everywhere on the London Passenger Transport Board's railways, from the Elephant & Castle to Rickmansworth, construction work may be seen in hand. This is evidence of the vigour with which London Transport and the main line companies are pushing ahead their £40,000,000 programme of extensions and developments.

Work is proceeding or is just about to begin on 45 London Transport stations. On the Bakerloo Line, a contract amounting to £120,000 has just been signed for the lengthening of 13 additional platforms, making 30 platforms in all to be lengthened on this line. The modernisation of Baker Street station is well advanced. A working shaft has been sunk at Elephant & Castle station, which is to be reconstructed to enable a 90-sec. peak train service to be worked. Compressed air plant is being installed as the work will have to be done in water-bearing ground. The line will be resignalled.

On the Central Line 28 station platforms are being lengthened. Without interrupting traffic, the whole of the existing tunnels, 22 miles, have been realigned. The board's engineers are now modernising the track. This includes conversion from third to fourth rail traction. Bull-head rails with cross sleepers will be fitted in place of the existing bridge type rail with longitudinal sleepers. More than 10 miles of new rails, which will be welded, will be laid. When the fourth rail has been laid throughout the line, the signalling will be altered to permit more trains to be run. The new St. Paul's station will be in service in December and will be completed in March next. At Mile End the new tube lines will be brought to subsurface level and placed at the same level on either side of the existing Mile End station on the Metropolitan and District lines.

On the District Line good progress is being made at Sloane Square, where the station is being modernised and escalators installed. The complicated reconstruction at Aldgate East is approaching completion. The present station will be closed and part of the new station will be opened for service at the end of this year.

On the Northern Line noise-reducing screens are being erected in the tunnels. About 6½ miles of work have been done.

On the Metropolitan Line the reconstruction of Harrow-on-the-Hill station has begun and contractors have started the earthworks necessary for the doubling of the line between Harrow and Rickmansworth.

An old Swedish State Railways Class "Ca" 2-4-0 locomotive No. 198 at Tomteboda, where numerous historic items of private and State-owned rolling stock are preserved

The company-owned locomotives include the second locomotive to be built in Sweden, turned out by Munktell, of Eskilduna, at the beginning of the fifties, and the first locomotives built by Nydqvist & Holm, and the Motala Works. The oldest State engines are "Prins August" (2-4-0) and "Göta" (2-2-2), built by Beyer, Peacock & Company in 1856 and 1866, and there are others representing all periods since then, including a 4-6-0 compound with a peat-burning firebox and covered tender. The preserved coaches range from early "miners' boxes" and an old three-compartment four-wheeler, to a very beautiful royal saloon formerly used by the present King and his predecessor

RECONSTRUCTION OF STAFFORD JUNCTION, L.M.S.R.

Trent Valley junction, Stafford, has now been converted to a high-speed, two-level junction, enabling trains on the main line to London to run over it at 55 instead of, as formerly, 30 m.p.h.

ON page 392 in our issue of February 25 last, we announced that the London Midland & Scottish Railway had put in hand the reconstruction and re-signalling of Trent Valley junction (Stafford No. 1 signal box), where the Euston—Crewe and Birmingham—Crewe main lines converge half-a-mile south of Stafford station. The design of the new junction embodies the principles described in the article entitled " High-Speed Junctions " by W. M. Bond, published in THE RAILWAY GAZETTE of October 2 and 9, 1936.

The principal traffic through this junction is to and from London over the Trent Valley section, and prior to the alterations now completed, up and down fast trains in that direction had to negotiate 25-ch. curves forming turn-outs from the Stafford—Birmingham lines which at that point had easy curves of 110-ch. radius. Consequently speeds in both directions and over both routes were limited to a maximum of 30 m.p.h., with great hindrance to traffic and wastage of fuel in regaining speed.

By slewing the fast roads and introducing a reverse curve, as clearly seen in our illustrations, the Trent Valley curves have been eased to 60-ch. radius, though the less-important Birmingham line curves are now 40 ch. on the down and 26-40 ch. on the up road. As, in addition, transition curves and two-level chairs have greatly assisted the smoothness of running through the junction, and as switch diamonds have been introduced in the new layout to improve still further the running throughout, speeds of 55 m.p.h. are now allowed over the up and down Trent Valley or London lines, and the speed for Birmingham trains remains at 30 m.p.h. The signalling also has been correspondingly improved. The alterations, which have cost about £8,000 on permanent way account and £2,000 for signalling, were carried out on Sundays at intervals during the spring, and, now that they have been completed, it is possible to realise their great advantages. For it is noteworthy that smooth running is now experienced at nearly twice the speed previously permitted, and a considerable saving in fuel and wear and tear is also effected.

Details of the Work Involved

The principal features of the work have been the flattening of the Trent Valley or London line curves on the fast roads in that direction, by the realignment of the whole junction. This has entailed slewing the Trent Valley roads through a distance of from 8 ft. to 11 ft. 7 in., and the Birmingham roads to a maximum of 10 ft. Where the lines pass under the Wolverhampton Road bridge, an 8-ft. slew was necessary. Many months of preliminary survey, drawing office, and laying-out work were necessary, the whole of the junction track work having been laid out first in the works of the manufacturer, Taylor Brothers of Sandiacre, near Nottingham, exactly as it was eventually laid at Stafford. Opportunity was also taken to lay a large Stafford Corporation sewer beneath the tracks. The work has been carried out with complete success under the direct orders of Mr. R. E. Bullough, District Engineer, Crewe, to the requirements of Mr. W. K. Wallace, Chief Engineer to the company. The altered track alignment and signalling changes may be seen from the accompanying illustrations.

Right : General view of Trent Valley junction, Stafford, looking north. The lines running off the left-hand edge of the illustration are the up and down Birmingham roads. Those to the right are the Trent Valley lines to and from London. The cross-over roads just south of the main junction are seen in the foreground. The left-hand curve emerging from the centre bottom of the picture is the down slow, with a cross-over road leading to the down fast. The next curve to the right, with the switches right in the foreground, is the down fast, with a cross-over road leading to the down slow. The next curve to the right is the up fast, with a cross-over road for the up slow. The extreme right-hand track, excluding the goods lines, is the up slow

Left: View of Trent Valley junction layout from signal box, looking northwards towards Stafford station, as it was before alteration. The two inner lines under the right-hand span of the road overbridge are the main or fast lines, (a) diverging with easy curves to the left towards Birmingham and (b) with sharp (25-ch.) curves to the right towards London. Note the bracket signal in the foreground

Right: View similar to above, but at intermediate stage during alterations. At that time the down fast line (to the right of the overbridge pier) still remained as before, but the up fast had been slewed to the right into its new position. Note the easy curve thus secured for the London line (as compared with the down fast line) at the expense of a sharper reverse curve for less important trains to Birmingham

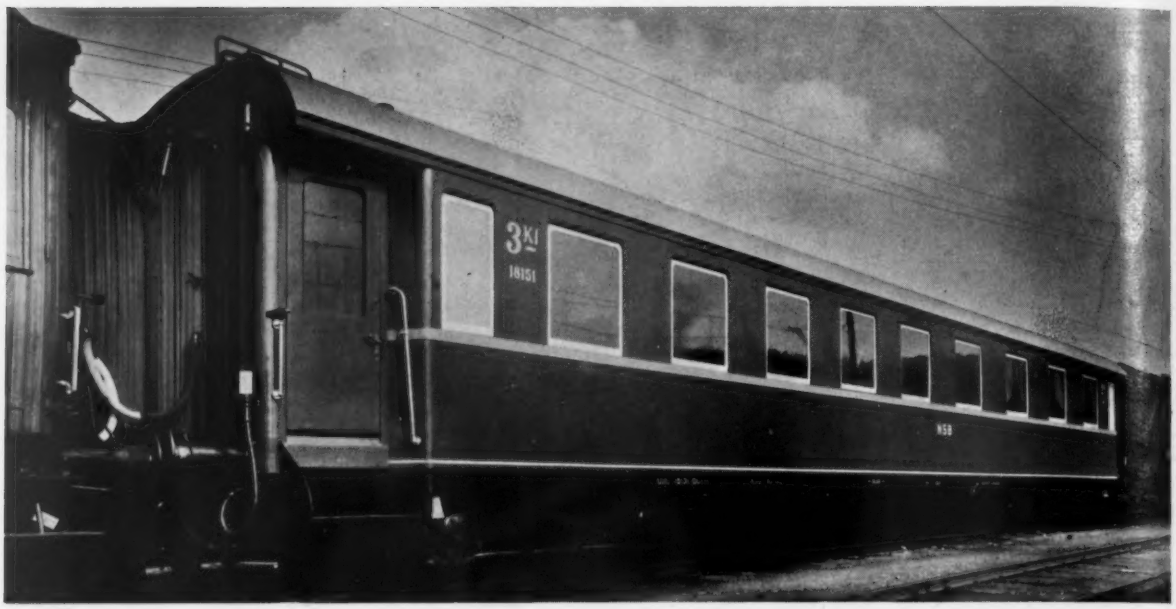
Left: Again from the signal box, the junction is here seen as realigned, with both fast lines to London laid with easy (60-ch.) curves, secured by introducing reverse curves. On each side of the reverse point is a cubic parabola, the transition reaching its maximum radius at the switches. A switch diamond at the intersection of the down London and up Birmingham fast lines can be seen set for the former. The bracket signal in the foreground has disappeared, but those beyond the overbridge have had fishtail arms added

Another view taken at the same time as the middle one opposite, showing the up fast lines in their final positions, track and points for the future down fast laid between the up and down fast roads, and other materials at site

View from the overbridge depicted in the above illustrations, looking south. The passenger lines curving to the left are the up slow and up fast and down fast London lines via the Trent Valley, and those curving slightly to the right are the Birmingham lines. Of the two roads cutting across the Birmingham main line, the right-hand one is the down slow from London. A new switch diamond is seen in the foreground set for the down fast London line train signalled

RECONSTRUCTION OF STAFFORD JUNCTION, L.M.S.R.

(*See article on page* 331)

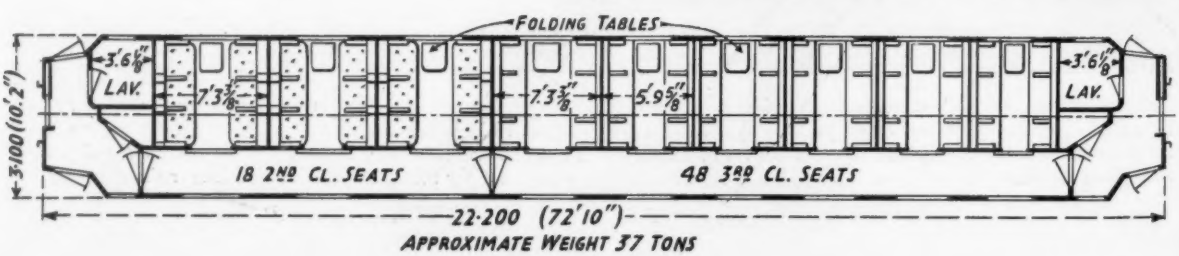


Standard All-steel Norwegian Coaches

Above: Exterior view of second and third class composite corridor carriage

Right: A corner of one of the second class compartments. Note the folding arm-rest and table—features also shared by third class accommodation—also electric reading lamp. Note also the carefully shaped seat designed to support the small of the back

Below: Seating plan of one of the coaches. Note the arm-rests for the corner third class seats and for all second class passengers, also dimensions and weight



APPROXIMATE WEIGHT 37 TONS

RAILWAY NEWS SECTION

PERSONAL

From *The London Gazette* of August 12: Territorial Army, Royal Engineers, Engineer & Railway Staff Corps: Major R. A. Thom, O.B.E., M.I.Mech.E., resigns his commission (August 13).

Mr. G. A. Musgrave, M.I.Mech.E., M.I.Loco.E., whose appointment as Locomotive Running Superintendent (Western Section), Southern Area, L.N.E.R., was recorded in our issue of August 5, was educated at Penistone Grammar School and began his railway career in 1902, as a premium apprentice at the former Great Northern Railway works, Doncaster, under Mr. H. N. (now Sir Nigel) Gresley, the present Chief Mechanical Engineer of the L.N.E.R. After serving his apprenticeship in the works and drawing office, Mr. Musgrave gained experience in the Locomotive Running Department at Ardsley and Colwick, and in 1908 took up the position of Assistant Foreman at King's Cross. In 1912 he took charge at Hatfield, and in 1913 was promoted to Assistant District Superintendent at Colwick. Mr. Musgrave had Army service in France during the great war in 1917 and 1918, being attached to the C.M.E. Department (Royal Engineers). In October, 1919, he became Shops Manager at Doncaster, and was appointed Works Manager, Cowlairs, Glasgow, the headquarters of the Scottish Area of the L.N.E.R., in July, 1930. Mr. Musgrave was appointed Locomotive Running Superintendent (Scotland), the position he now vacates, in 1931.

Mr. G. A. Musgrave

Appointed Locomotive Running Superintendent, (Western Section), Southern Area, L.N.E.R.

Mr. C. H. M. Elwell, B.Sc. (Eng.), who, as recorded in our issue of August 5, has been appointed Locomotive Running Superintendent (Eastern Section) Southern Area, L.N.E.R., was educated at Haileybury College and at London University. He was then apprenticed to the late Mr. James Holden, Locomotive Superintendent of the former Great Eastern Railway, at Stratford, and was subsequently engaged as a Locomotive Inspector, as Materials Inspector, and in the Drawing Office. He then served for two years as Technical Assistant to Mr. C. W. L. Glaze, then Works Manager, afterwards assisting the late Mr. A. J. Hill, C.B.E., Chief Mechanical Engineer, as Assistant on special war work, including the manufacture of munitions at Stratford works, Railway Priority Committee work, the allocation of steel to British railways, and purchases of railway material in America. In 1919 Mr. Elwell was appointed District Mechanical Engineer for the Norwich District, transferring in 1921 to Cambridge as Assistant Divisional Superintendent of Operation, and subsequently becoming District Locomotive Superintendent of the Cambridge District, L.N.E.R., early in 1924. In 1926 Mr. Elwell was appointed Assistant to the Locomotive Running Superintendent, Southern Area.

Elliott [*& Fry*

Mr. C. H. M. Elwell

Appointed Locomotive Running Superintendent (Eastern Section), Southern Area, L.N.E.R.

Mr. A. S. Buswell, whose appointment as District Passenger Manager, Newcastle, L.N.E.R., was recorded in our issue of August 5, was born in 1885, educated at Newton's Grammar School, Leicester, and joined the former Great Central Railway as an assistant clerk in the office of the District Engineer at Leicester in 1900. He was promoted to the higher grade staff in 1910, and on completing his course of training in July, 1914, was appointed Assistant to the Chief of the Rates and Fares Section in the Superintendent's Department. On Mr. H. Hunt leaving the Great Central service to take up the position of General Manager of the Londonderry & Lough Swilly Railway, Mr. Buswell succeeded him as Chief of the Rates and Fares Section of the Superintendent's Department. In 1919 he was Chairman of the Passenger Train Rates and Fares Conference at the Railway Clearing House, and in January, 1920, was appointed Assistant Traffic Manager (Operating) for the Southern Division of the Great Central Railway, in succession to Mr. S. E. Fay. He was appointed Assistant District Superintendent, Marylebone, L.N.E.R., in October, 1923, and in December, 1927, became Assistant District Superintendent, Manchester. In 1936 Mr. Buswell was appointed District Passenger Manager, York. Mr. Buswell is a Foundation Member of the Institute of Transport.

Mr. A. S. Buswell

Appointed District Passenger Manager, Newcastle, L.N.E.R.

Mr. Robert Cameron has been appointed Acting Traffic Manager of

the Buenos Ayres & Pacific Railway, succeeding Mr. John C. Sommerville, who was Traffic Manager of the system from 1932 until his retirement this summer.

Mr. G. H. Nutter, who, as recorded in our issue of August 12, has been appointed District Goods and Passenger Manager, Stoke, L.M.S.R., began his railway service in the General Manager's Office of the former Lancashire & Yorkshire Railway. He served in different departments of that office until subsequently transferred to the Chief Traffic Manager's Office, where he occupied various positions in the Private Sidings, New Works, and other sections, for several years, until appointed in 1915 to the personal staff of the Chief Goods Manager, the late Mr. Herbert Marriott. An appointment as Assistant to the L. & Y. Company's District Manager in Manchester followed in 1920, a position he held until appointed in 1925 as Assistant District Goods Manager of the L.M.S.R. in Manchester consequent upon the general reorganisation after the amalgamation, a position he now vacates to take up his new duties at Stoke-on-Trent as from October 1 next. Mr. Nutter has taken a keen interest in the First Aid Movement on the railways. He was Honorary Secretary of the Lancashire & Yorkshire Centre of the St. John Ambulance Association from 1911, and of the L.N.W.R. Ambulance Centre for a period after amalgamation. He served on several committees of the association, and is an Officer of the Order of St. John of Jerusalem in England. He has been associated with many railway social and sporting organisations in the Manchester District, and has taken a prominent part in organising the annual amateur boxing tournaments for the Goods Department staff in the district, which have resulted in considerable sums being raised for the Railway Servants' Orphanage at Derby during the past three years. Mr. Nutter was elected an Associate Member of the Institute of Transport in January, 1922, and to full membership in December, 1937.

Mr. H. E. Horne, whose appointment as Acting Assistant Chief Commercial Manager, Euston, L.M.S.R., was recorded in our issue of August 12, is a native of Leeds, and entered the service of the former Midland Railway as a junior clerk at Armley (Leeds) in December, 1888. After experience in various capacities at Newlay & Horsforth, and at Newark-on-Trent, he went in 1896 to Derby, where he was subsequently appointed Relief Clerk, and engaged primarily in relieving stationmasters. He was appointed Stationmaster at Harpenden in 1899, became Stationmaster at Cheltenham in 1907, and for the greater part of 1909 was at Derby with Mr. (afterwards Sir) Cecil Paget, the then General Superintendent, in connection with special work. In December, 1909, he went as Stationmaster to Leeds (Wellington), a post which he held until October, 1916, when he was transferred to Derby as Assistant Superintendent of Passenger Services. Mr. Horne occupied this position at the formation of the L.M.S.R. in January, 1923, when he was appointed Assistant for Passenger Services to the Chief General Superintendent. In June, 1929, he was appointed Assistant General Superintendent (Passenger Commercial); Assistant Passenger Manager on October 1, 1931; and in October, 1932, Assistant (Passenger) to the Chief Commercial Manager. While at Derby as Assistant to the General Superintendent of Passenger Services, Midland Railway, Mr. Horne was largely responsible for the introduction and subsequent organisation of the system of passenger train control. In August, 1935, Mr. Horne was appointed Assistant Chief Commercial Manager (Passenger), Euston.

Mr. H. E. Pedley, who, as recorded in our issue of August 12, has been appointed District Passenger Manager, Liverpool, L.M.S.R., entered the service of the late Midland Railway Company in the office of the Superintendent of the Line, Derby, in March, 1897. He passed through various sections of the Commercial Department, covering both indoor and outdoor duties. On the amalgamation, Mr. Pedley was appointed Chief Traffic Development Clerk in the department of the Passenger Commercial Superintendent at Derby in February, 1925. While on the centralisation at Derby of the passenger rates and fares offices of the companies forming the L.M.S.R. group, he occupied the position of Deputy Passenger Rates and Fares Assistant to the Passenger Commercial Superintendent. In May, 1929, Mr. Pedley was appointed to the position of the company's Railway Clearing House representative, responsible for all matters relating to the Passenger Department, and during 1930 he was Chairman of the Passenger Train Rates and Fares Conference. In April, 1931, Mr. Pedley was appointed Chief Parcels Clerk to the Passenger Commercial Superintendent at Derby, and in October, 1932, he returned to the Passenger Rates and Fares Office to take charge of that section under the Chief Commercial Manager, with headquarters at Euston, which position he now vacates to become District Passenger Manager at Liverpool.

Ing. Arturo Noni has been appointed Director-General of Railways in the Argentine Public Works Department,

Photo [*Lafayette*

Mr. G. H. Nutter

Appointed District Goods & Passenger Manager, Stoke, L.M.S.R.

Mr. H. E. Horne

Appointed Acting Assistant Chief Commercial Manager, Euston, L.M.S.R.

Mr. H. E. Pedley

Appointed District Passenger Manager, Liverpool, L.M.S.R.

in succession to Ing. Manuel Garcia Torre, who, as recorded in our issue of July 29, has been appointed a Member of the newly-formed Buenos Aires Transport Corporation.

Mr. G. F. Sampson, Traffic Manager, Central Argentine Railway, sailed for Europe on leave of absence by the Royal Mail liner *Almanzora* on July 20.

Mr. Robert Flack, Chief Accountant, Central Argentine Railway, returned from leave of absence in Europe by the Royal Mail ms. *Asturias* on July 26.

OVERSEAS OFFICERS HOME ON LEAVE

Brig-General Sir G. D. Rhodes, C.B.E., D.S.O., General Manager, Kenya & Uganda Railways.

Mr. H. B. Emley, C.M.G., General Manager, Sudan Railways.

Mr. H. E. Allwood, Chief Mechanical Engineer, Sierra Leone Government Railway.

Major C. R. Turner, Chief Mechanical Engineer, Gold Coast Government Railway.

Mr. A. K. Southern, Superintendent, Running Section, Bengal-Nagpur Railway.

Mr. J. Campbell, Technical Assistant to Chief Mechanical Engineer, Buenos Ayres & Pacific Railway.

Mr. M. Patterson, Running Superintendent, Buenos Ayres & Pacific Railway.

Mr. J. H. Dunbar, M.C., Chief Mechanical Engineer, Sudan Railways.

From *The London Gazette* of August 9: Territorial Army, Royal Engineers, Engineer & Railway Staff Corps: Lt.-Colonel Jonathan Roberts Davidson, C.M.G., M.Sc., M.Inst.C.E. (late T.F. Res.), to be Colonel (August 10).

INDIAN RAILWAY STAFF CHANGES

Mr. T. Stephenson, Acting Chief Commercial Manager, M. & S.M.R., has been granted eight months' leave as from August 4.

Mr. H. G. Carpenter, Deputy Commercial Manager, has been appointed to officiate as Chief Commercial Manager in his place.

The following officers on the State Railway cadre (Indian Railway Service of Engineers) have been promoted permanent or provisional permanent Deputy Chief Engineers: Messrs. A. C. Griffin (Secretary, Railway Board), J. C. O'Neill, E.B.N. Taylor, H. G. Salmond, and A. M. Sims.

We regret to record the death on August 4 of Captain J. V. Forster, General Agent of the Canadian Pacific Railway at Southampton. He joined the Canadian Pacific Company in 1903, and was in command of several vessels prior to his appointment as Steamships Manager at Liverpool in 1921. He went to Southampton as General Agent in 1933.

Mr. Arthur Feirn, O.B.E., who has just retired from the Ministry of Transport, began his railway career with the former Great Northern Railway Company. He accepted a position in the Financial Department of the Ministry of Transport in 1920, and for several years was engaged in the liquidation of the claims arising from the Government control of the railways during the great war. Mr. Feirn subsequently took charge of the Transport Accounts branch of the Ministry of Transport. On his retirement, Mr. Feirn was presented by Mr. R. H. Hill, C.B., on behalf of the staff of the Ministry, with a wireless set, a gold wristlet watch, and an autographed book containing the signatures of his colleagues.

Mr. William Martin Hind has been appointed Transport Accounts Officer in the Ministry of Transport in succession to Mr. Arthur Feirn. Mr. Hind began his railway career in the Accountant's Office of the former North Eastern Railway and left his position as Personal Clerk to the Accountant in 1915 to join H.M. Forces. He was wounded in France whilst Acting Captain with the 9th Battalion, Durham Light Infantry, and later joined the staff of the late Sir Eric Geddes at the Admiralty, afterwards assisting in the preparation of the Ministry of Transport Bill under which the main line railways were grouped. On the formation of the Ministry of Transport, Mr. Hind was appointed to the Finance Department, where he was associated with the railway officers engaged upon the investigations of the companies' accounts relating to the period of Governmental control. Mr. Hind subsequently assisted in connection with the preparation of statutory forms of accounts for a number of transport and other undertakings, including the London Passenger Transport Board and the Central Electricity Board. He is also Auditor of the Railway Freight Rebates Fund.

STAFF AND LABOUR MATTERS

Railway Signalmen's Wages

In last week's issue of *The Railway Review*, Mr. John Marchbank, General Secretary of the National Union of Railwaymen, commenting upon Railway Staff National Tribunal Decision No. 4, which deals with the rates of pay and conditions of service of signalmen, wrote as follows:—

"The decision concedes only relatively minor adjustments under the marks system. The union's proposal for a regrading under the system has not been accepted in its entirety, and extra marks have been allowed only in two cases. I regret that the tribunal has not seen its way to adopt our proposal for a six-hour day. As I read the decision, however, it cannot be taken as an answer to the union's contention that the signalmen's work has become more exacting, and that the mental and physical strain has increased. Nor is it an answer to our plea that mechanical innovations since 1922 have enabled the companies to reduce the number of signalmen, and to effect economies which ought in equity to be shared with the employees.

"The tribunal, in fact, based its determinations upon two considerations which are aside from the main case I put forward: one is that our proposals as regards pay and conditions of signalmen would upset the balance with other grades; and the other, that the general increase we proposed would have a serious effect upon the finances of the companies. The tribunal, indeed, says that the question of increased pay for signalmen could only be properly considered on the basis of an examination of the whole financial position and prospects of the companies. Accordingly the tribunal limited its findings, and rather implies that the door is open for further consideration at a later stage, when fuller experience of the marks system is available.

"In its decision, the tribunal after stating that the union's claim would involve an additional annual cost of about £1,000,000, continues: "It is obvious that any change in the remuneration of signalmen, of the order of magnitude involved in the union's claim, would make a considerable difference in the relative remuneration of this and other grades, unless similar changes were made also in respect of these other grades. It is also obvious that any general increase, of the kind proposed, would have a serious effect upon the general finances of the railway companies and could, therefore, only be considered on the basis of an examination of their whole financial position and prospects."

The tribunal states that it has been limited to consideration of comparatively minor adjustments which either further experiences of the working of the marks system since 1922, or changes since that date in the methods, instruments, and organisation of the signalling service—with consequent changes in the strain and responsibility falling upon certain signalmen—have shown to be desirable and justified.

The decision of the tribunal, which cannot be given effect to until accepted by the union and the railway companies, was considered by the executive of the National Union of Railwaymen on August 8, when it was decided to call a special delegate conference to consider the matter, and Mr. Marchbank's comments probably reflect the attitude which will be taken at the delegate conference.

MINISTRY OF TRANSPORT ACCIDENT REPORT

Rutherglen, L.M.S.R.: April 8, 1938

At about 2.27 p.m., as the 1.38 p.m., Lanark to Glasgow Central, consisting of four bogie coaches and a 4-4-0 tender engine, was approaching Rutherglen station at its usual speed of 50 m.p.h., the trailing axle of the leading bogie of the first coach broke close to the left-hand wheel seat, resulting in complete derailment of that coach, partial derailment of the next two, and complete derailment of the fourth. One passenger was killed and one fatally injured; eight were detained in hospital. All casualties were in the fourth coach (which mounted the nearside platform ramp, broke away, was overturned and considerably damaged) and for the most part were due to passengers being thrown about. Rescue work was prompt and efficient. Major G. R. S. Wilson conducted the inquiry.

The train stopped at all stations to Motherwell, and was booked non-stop thence to Glasgow. The leading coach, No. 10086, on which the axle broke, was built in 1928, with wood body. The others were built in 1935 with steel panelled oak and teak framing on steel underframes; except for No. 20802, which was overturned, they were little damaged. The initial derailment took place 50 yd. in rear of Dalmarnock junction signal box, itself 170 yd. in rear of the platform ramps. Running had been normal to that point, but Driver R. McCulloch heard an unusual crack at the junction, saw the first coach rocking, and stopped 510 yd. from the first mark of derailment. Several members of the staff witnessed the accident. Signalman J. Beattie, Dalmarnock junction, said he saw smoke and dust rise as the train passed, and the last vehicle mount the platform ramp and overturn violently.

There is no doubt that the axle breakage was the cause rather than the result of the derailment. The permanent way was of 95-lb. R.B.S. material in first-class order. There was no evidence that a flange had mounted the rail in the ordinary way of derailment; for the first 170 yd. from the initial marks (seven yards ahead of a trailing "V" crossing) damage was slight, chairs and screws being marked on the inside only; a few chairs were broken, and the end of a check rail on the left-hand side was indented. A wheel or wheels appeared to have been diverted to the left by the open right-hand switch of a facing connection 55 yd. short of the platform ramp; this, together with the considerable damage to the permanent way which followed, must have accounted for the extensive nature of the final derailment and the departure of the last coach from track alignment. It was unfortunate that it fouled the platform ramp; otherwise the results would have been much less serious.

The fracture was due to a growing fatigue flaw which originated on the wheel seat flush with, or just inside, the inner end of the wheel boss. The coach, carried on two 4-wheeled bogies and weighing 27 tons, was built at Wolverton in January, 1928, when the axle was fitted new. At the last general overhaul at St. Rollox works in August, 1936, the axles were thoroughly scraped and cleaned, including the portions adjacent to the wheel bosses, and closely examined in accordance with the usual practice when coaches are in the shops for general repairs. No sign of a flaw in any axle was detected, but it is very doubtful if it would have been possible to detect the flaw in question, having regard to its concealed position, even had it been in existence. Mileage of local stock is not recorded, and it is not possible to estimate total mileage run. The usual outside or "train" examination was carried out at Glasgow Central before the coach left as part of the 7.55 p.m. train to Lanark the evening before the accident. No defect was noticed by Examiner H. Fordyce on this occasion, nor could he have been expected to detect a flawed axle at a routine examination of this kind. No blame, therefore, rests with him.

Particulars of Axle

The axle was manufactured in 1927 from open hearth acid steel in accordance with the company's standard specification; there is no record of any other failure of the 31 axles from the same cast. It was 7 ft. 4¼ in. over all and, as it carried a dynamo pulley, was turned all over; the brand marks were on the end. The wheel seat was $7\frac{9}{16}$ in. long and of standard diameter, 5¼ in.; the parallel dynamo pulley seat, 4⅞ in. diameter, was 6½ in. long, off-set from the middle of the axle, with a gradual taper from the wheel seat on each side. The wheel adjacent to the fracture was pressed on with a pressure of 72 tons, compared to the standard of 70 tons with a tolerance of 5 tons either way. The fracture had the appearance of a typical growing flaw, extending for 81 per cent. of the cross-section and approximately 225 deg. of the circumference, the final fracture being regular and crystalline. The whole surface of the flaw was discoloured by corrosion but the discolouration was less marked on the inner third, indicating comparatively recent and probably more rapid growth in later stages. It was considered that the flaw might have been in existence up to two years.

The wheel was pressed off the broken end of the axle at St. Rollox before Major Wilson, nearly 150 tons pressure being required to start the movement. Tool marks were scarcely discernible on the surface of the wheel seat, which was bright and polished, except for the first ¼ to ⅜ in. at the inner end, where there was a certain amount of corrosion all round and some brick red rust. This condition appeared to be normal, similar evidence of slight corrosion at the same point on other carriage (and locomotive) axles, from which the wheels had been removed, being seen. There was, however, no appreciable pitting, which in previous failures has been considered as a possible cause.

Corrosion was referred to in a report of the company's Research Department, to which the broken parts were submitted. The origin of the flaw was not ascribed to it, however, but to the effect of grooving, which may have been initiated by a tool mark, at a point of high stress concentration. The report disclosed that, as a result of chemical analysis and the usual tensile, cold bend, and impact tests, the steel in the immediate neighbourhood of the fracture was of satisfactory and suitable quality, in no way inferior to specification.

Inspecting Officer's Conclusion and Remarks

This derailment was caused by a broken axle, due to a fatigue flaw, probably initiated by a tool mark, which had gradually developed, under continual reversal of stress, until it extended for 81 per cent. of the cross-section of the axle. With such a large area flawed the remaining strength was so reduced that failure could have been expected at any time under ordinary running conditions. Owing to the high stress concentration, the edge of the wheel seat is a point where flaws are particularly liable to start, and their detection in this position is almost impossible unless the wheels are pressed off. To do this at frequent intervals would involve prohibitive cost, and would hardly be justified having regard to the low incidence of failure, an average of only 3 per annum having been recorded throughout the country in the last six years.

The company, however, partly as a result of this accident and the somewhat similar case at Crewe last year (see THE RAILWAY GAZETTE for July 30, 1937) and partly owing to increasing train speeds, is taking further steps towards the prevention of flaws of this type which, it appears, generally originate with a tool mark, or as the result of corrosion. Stress intensity is being reduced by an increase in diameter of the wheel seat, from the present standard of 5¼ in., of new axles of all classes of coaching stock. Also all new carriage axles are to be ground on the wheel seat, or fine-turned with a special tool and then polished, which is considered to give a superior surface finish to grinding. New axles for high-speed stock are to be similarly finished all over and protected against corrosion by paint or otherwise. Whether this practice is to be extended to new axles for ordinary stock depends on the result of experiments now in progress,

which have already met with some success, to discover a reasonably economical means of detecting existing flaws when coaches are in the works for general repairs. It is considered that to turn the axles over their length with ordinary tools involves more risk than leaving them rough forged; moreover, the forge scale gives appreciable protection against corrosion.

With regard to axles already in service, the company is considering the extension to all passenger stock of the arrangement now in force for main line stock, whereby axles, after 15 years' life, are subject to close examination after pressing off the wheels, but no decision has yet been reached, as much depends on the final results of the experiments referred to above. A satisfactory method of detecting concealed flaws, if found practicable, would indeed be of more value.

Joint Poster Advertising

The public has for some time been familiar with posters issued jointly by the L.M.S.R. and the L.N.E.R. advertising Anglo-Scottish services. Equally successful, although perhaps as yet less generally known, have been the results of co-operation between the Great Western and the Southern Railways in the production of posters advertising areas served by both. "Weymouth" is a particularly lively essay in the pictorial map, for which the Southern Railway is responsible. It owes its immediate appeal to the clear blues and greens in which it is reproduced, and upon closer inspection holds the interest by the novel manner in which the old and new are combined. The twenty ships furnished by Weymouth for the siege of Calais are seen lying in the foreground, alongside two galleons captured by Weymouth vessels from the Spanish Armada, and here shown being triumphantly escorted towards the shore. Further away are units of the modern battle fleet at anchor, while paddle steamers here and there recall to the landsman how if he visits Weymouth he can capture the thrills of seafaring.

Two co-operative posters advertising Plymouth, and Guernsey, are G.W.R. designs. "Plymouth" is an attractive bird's-eye view of lawns, promenade, and water, with two flying boats overhead to recall the naval associations of the town. The poster of Guernsey, described at the foot as "the sunshine island," presents two holiday-makers in the foreground looking down from a cliff-top upon a series of bays and headlands, with bathers and boats in the nearest cove to give animation to the scene.

Another co-operative poster issued by the G.W.R. advertises the services by that company and the L.M.S.R. to the Wye Valley, represented by a landscape in which a delicate colouring of trees, hills, and water produces an effect of misty distance and peace.

High-Speed Performances in France

A summary of the highest speeds that have been attained in France by locomotives rebuilt with the Chapelon modifications, or built new to the same designs

In an editorial article in our issue of July 8, commenting on the speed of 125 m.p.h. reached by the L.N.E.R. streamlined "A4" class Pacific *Mallard*, with Kylchap double blast-pipe and double chimney, we remarked that it would be a matter of interest to know what maximum speeds had been recorded with French locomotives that have been rebuilt with the Chapelon modifications, designed to provide the greatest possible freedom to exhaust at high speeds. We have since received from M. André Chapelon himself an interesting communication on this subject. It is well known that there are in France maximum limits to the speed of trains, enforced by law, that are considerably lower than the speeds permitted and freely attained in Great Britain, but on numerous occasions when test journeys have been in progress, these limits have been relaxed. At the same time it is doubtful if any serious attempt has yet been made in France to extend these or other locomotives to the highest speeds of which they are capable, the speeds now to be mentioned being incidental to the tests concerned rather than their principal aim.

On the Paris—Orleans—Midi line (now the South-Western Region of the S.N.C.F.), on February 19, 1935, with a load of three bogie vehicles weighing 156 *tonnes* (154 tons), 4-6-2 engine No. 3705, cutting off at 35 per cent. in the h.p. and 45 per cent. in the l.p. cylinders twice touched 159 km.p.h. (98·8 m.p.h.) on a practically level track with slight undulations at about 1 in 500. Between Les Aubrais and Etampes, the distance of 31·7 km. (19·7 miles) from Chevilly to km. post 73·1 was covered in 12 min. 27 sec., at an average of 152·7 km.p.h. (94·9 m.p.h.); between km. posts 76 and 74 the average speed was 96·9 m.p.h., and a mean drawbar h.p. of 747 was required to maintain this speed. On March 9 the same locomotive, with a load of six bogie vehicles weighing 308 *tonnes* (304 tons), and a strong headwind, maintained an average speed of 150 km.p.h. (93·2 m.p.h.) for 33 km. (20·5 miles) from Chouzy to Vernou; the average drawbar h.p. was 1,340 and the cut-offs required were 50 per cent. in the h.p. and 55 per cent. in the l.p. cylinders, down a slight gradient averaging 1 in 2,000. At the time when this run was made, the engine had completed 85,000 km. (52,800 miles) since its last previous general overhaul. On the same day, in the opposite direction, with a following wind, No. 3705 maintained the same average speed with the same load, but against the rising tendency of the road; yet the cut-offs required were only 30 to 35 per cent. in the h.p. and 40 to 45 per cent. in the l.p. cylinders —a striking object lesson of the relative effects of adverse and favourable winds on locomotive running. The force of the wind was calculated at 32 km.p.h. (20 m.p.h.).

On March 11 the test was repeated, but with load now increased to eight vehicles of 409 *tonnes* (403 tons), and with engine No. 231.724 of the second series of rebuilt Pacifics. The wind, as before, was blowing at 32 km.p.h. (20 m.p.h.), and was a headwind to trains running south. On this run the engine maintained an average of 150 km.p.h. (93·2 m.p.h.) over the 27 km. (16·8 miles) from Onzain to Vernou, against the wind; 55 per cent. cut-off was used in both h.p. and l.p. cylinders, and the drawbar h.p. developed was between 1,700 and 1,800; a maximum speed of 156 km.p.h. (97 m.p.h.) was attained. This locomotive had run 55,000 km. (34,180 miles) since its last previous general overhaul. An interesting point arising out of these tests was that at 150 km.p.h. (93 m.p.h.), all-metal coaches weighing 50 *tonnes* were shown to have a resistance of 7 kg. per *tonne*. As regards the highest speed on record with these locomotives, one of the P.O.-Midi Pacifics, when under test on the Nord main line on September 13, 1935, with a train of 300 *tonnes* (296 tons), attained 164 km.p.h. (102 m.p.h.), and on another test run with a 400-*tonne* train (393 tons), the same engine reached 174 km.p.h. (108 m.p.h.) near Chantilly, on the 1 in 200 falling grade from Survilliers to Creil. But M. Chapelon emphasises that, although plans have been under consideration for testing the streamlined P.O.-Midi Pacific No. 231.726 to the maximum speed attainable, these have not yet materialised meantime, the speeds just quoted, though interesting, cannot be regarded as final.

THE QUEEN OF THE NETHERLANDS.—During the celebrations of the 40th anniversary of the reign of Queen Wilhelmina of the Netherlands, the L.N.E.R. has arranged to issue cheap tickets to Holland to cover the week-end, as well as period excursions valid from six days to one month. The tickets will be issued to the Hook of Holland, Flushing, the Hague (for Scheveningen), Amsterdam, and Rotterdam, and the fares vary from £2 1s. 10d. upwards from London (Liverpool Street station). Similar tickets will also be issued from provincial stations. The week-end cruise vessel *Vienna* is to visit Amsterdam and the Hook of Holland on September 3 and 4, when there will be a naval display and review of the fleet, with special illuminations and fireworks. Special decorations and displays are also being arranged in Rotterdam.

NOTES AND NEWS

Railway Damage in Palestine.—Several railway stations have recently been looted and burnt in Palestine, notably Jabneh on the main line and Bittir on the Jerusalem-Lydda section.

"Board of Trade Journal."—The editorial office of the *Board of Trade Journal* is now at 80, Pall Mall, London, S.W.1. The telephone number is Whitehall 3880.

Snodland Level Crossing.—For the installation of mechanically-operated gates the Snodland level crossing, near Rochester, was closed to traffic from 10.30 p.m. on Saturday last until 9 a.m. on Sunday; it will also be closed on the night of Saturday-Sunday next.

Irish Channel Motorcar Transport.—A new era in motorcar transport between Scotland, England, and Ireland will be marked by the introduction of the vessel which William Denny & Bros. Ltd., Dumbarton, is building for the London Midland & Scottish Railway Company. The vessel will be engaged on the Stranraer-Larne service for the carriage of motor vehicles. Alterations are being made at the railway company's piers at Stranraer and Larne which will enable vehicles to go on board without any lifting by crane. The vessel will be in service for the beginning of next year's traffic.

"Specials" for Blackpool Illuminations.—Nearly three-quarter million people are expected to be conveyed by the L.M.S.R. to Blackpool during the period of the illuminations, from September 16 to October 24. The transport of this number from over 300 centres in England, Scotland, and Wales will necessitate running 1,456 excursion trains to Blackpool from as distant places as Plymouth, Dundee, Glasgow, and Swansea. The heaviest week-end for handling traffic is that beginning on Saturday, September 24, when over 200 excursions will be dealt with at the Blackpool stations.

New L.M.S.R. Container-Building Plant at Earlestown.—In order to carry out more rapidly and economically the repair of railway freight vehicles and the manufacture of road-rail containers, the L.M.S.R. is undertaking important schemes of development at its wagon works at Earlestown (Lancs) and Bromsgrove (Worc.). The building of all containers manufactured by the company is already concentrated at Earlestown, and under the scheme now in progress this work will be undertaken in a new layout which is in course of being installed in what was formerly the wheel shop, involving extensive conversion together with the installation of high-frequency tools, overhead runways, staging, lighting, heating, and other equipment. In this new plant, which will have an output capacity of from 800 to 1,000 containers per annum, it will be possible to build a container in about two working days; the L.M.S.R. already possesses over 8,340 of these units.

Madras & Southern Mahratta Railway.—In accordance with notice already given, the 4 per cent. debenture stock (1938) will be paid off at par on and after Saturday, October 1. The final interest payment will also be made on that date.

Boarding Road Vehicles—Hints for making travel on London Transport vehicles still safer and more comfortable are contained in a leaflet recently issued by the board. This is for circulation among the general public and copies may be obtained through the usual London Transport sources.

Bolivian Railway Scheme.—The Bolivian Minister of Works, according to Reuters, has under consideration the construction of a railway from Machacamarca in Bolivia to Pando on the south coast of Uruguay, at a cost of £1,000,000, to facilitate the exportation of minerals. The work would be carried out by Patino Mines and Enterprises Consolidated, which owns a railway of 57 miles connecting the mines with the Antofagasta Railway system.

L.S.E. Department of Business Administration.—A recent development for London evening students is a change in the regulations governing applications for L.C.C. senior scholarships. These are now available to students wishing to attend the department's one year postgraduate course, provided that they have a London residential qualification. Applicants must have been employed in business, and have attended evening classes for at least two years at the London School of Economics or at a polytechnic or a technical institution. The scholarships cover fees plus a maintenance allowance which, for self-supporting students, may be as much as £160 a year. For the 1938-39 course there are available a Leverhulme postgraduate scholarship, value £120 per annum, and also a limited number of bursaries, equivalent to remission of fees.

Period Costumes and Period Train at King's Cross.—The L.N.E.R. has now completed its arrangements for the running of the excursion to Cambridge, on August 24 by the Flying Scotsman train of 1888 (a preliminary announcement appeared in our columns last week). The scene will be reminiscent of what might have been seen on the departure of this famous train 50 years ago. The train itself will form a background against which passengers will promenade in the costumes of the period. An elderly lady complete with bonnet, bustle, and lace trimmings, will be there with her daughter; in attendance will be a "man about town" of the elegant 'eighties, whilst a tennis girl of the period, together with a varsity oarsman, will represent the younger sporting types, and a gentleman in shooting clothes complete with deer-stalker cap will complete the tableau. The demand for tickets in advance for this excursion has been extremely heavy and many railway enthusiasts are taking advantage of the opportunity for a ride behind a single-driver locomotive, the last of which disappeared from British main lines over a generation ago.

Pile and Timber Trestle Bridge in U.S.A. Destroyed by Fire.—The Chicago, Milwaukee, St. Paul & Pacific Railroad is not yet at the end of its epidemic of accidents apparently. Succeeding the serious collision and later bridge washout and train disaster, recently recorded in these columns, a timber pile and trestle bridge was destroyed by fire near Mildred, also in Montana, on July 21. The bridge was a six-span structure just under 100 ft. in length and 23 ft. high. Interruption of traffic lasted, however, only about 24 hr. The cause of the fire has not yet been ascertained.

Road Accidents.—The Ministry of Transport return for July of persons killed or injured in road accidents is as below. The figures in brackets are those for the corresponding period of last year.

	Killed	Injured
England—		
Pedestrians ...	170 (187)	5,144 (5,164)
Others... ...	292 (328)	14,007 (14,715)
Wales—		
Pedestrians ...	12 (12)	249 (253)
Others... ...	20 (19)	671 (673)
Scotland—		
Pedestrians ...	24 (32)	640 (635)
Others... ...	36 (29)	1,277 (1,290)
	554 (607)	21,988 (22,730)

The total fatalities for the preceding month were 536, compared with 526 in the corresponding period of 1937.

Storm Damage on Railways.—Violent rain and thunderstorms in various parts of the country on August 11 and 12 caused some interruption to railway traffic, and at Strathaven, Lanarkshire, on August 11, a train was derailed, on the L.M.S.R. line from Glasgow Central, 20 ft. of embankment having collapsed in a landslide. Two coaches were derailed, but only two persons were slightly injured. Further south, floods at Walden on the L.M.S.R. line from Manchester to the West Riding held up trains to and from Yorkshire on August 12, and on the evening of the preceding day, flooding of the cutting west of Willesden Junction prevented the running of Bakerloo Line trains between there and Wembley, passengers transferring to the L.M.S.R. steam services.

Delaware & Hudson Bank Loans.—It is reported from New York that the Delaware & Hudson Railroad Corporation has reduced its bank loans by more than $5,000,000 (£1,000,000) since the beginning of this year. They total $5,000,000 at present, compared with $10,113,000 (£2,022,600) on December 31 last. The *Financial Times* correspondent states that this reduction is believed to have been made through the sale of investment securities. It was announced that there have been no sales recently

of the line's New York Central Railroad holdings, which amounted to 410,000 shares at the end of 1937.

Great Western of Brazil Railway.—The scheme of arrangement submitted to the debenture holders has now been sanctioned by the High Court, and the relative positions of the six per cent. and four per cent. debentures have become regularised. A moratorium is now in force for a maximum period of three years. Failing help from the Brazil Government, there is no reason to expect any marked improvement in the position during the current year.

Remarkable Work by Indian N.W.R. Bridge Department.—In our Overseas columns this week, on page 321, the damaging by tribesmen of a bridge near the Indian N.W. Frontier, on the Kalabagh-Baunu Section of the North Western Railway, is described. The damaged girders had to be removed and replaced as quickly as possible, and orders were issued to the Bridge Department of the railway to supply two new 40-ft. deck-type spans. A smart piece of work was achieved by that department in that the new spans were fabricated at and despatched from its Jhelum workshops within 48 hr. of receipt of the order. This would have been creditable enough had the spans been of the normal square type, but actually they had to be built on the skew, one girder being 3 ft. 3 in. in advance of the other, necessitating the whole of the bracing being arranged accordingly.

South African Railway Finances.—A Reuters message from Cape To w dated August 11, states that after meeting working expenditure and interest on capital, it is estimated there will be a gross surplus of £4,712,720 to the credit of the South African Railways and Harbours Administration. To this must be added the unappropriated surplus of £320,769 brought forward from last year, making in all £5,033,489 available for appropriation. The sum of £5,028,648 will be used for various services, leaving a small surplus of £4,841.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 32nd Week			Totals to Date.		
	1938	1937	Inc. or Dec.	1938	1937	Inc. or Dec.
	£	£	£	£	£	£
L.M.S.R. (6,834¾ mls.)						
Passenger-train traffic...	696,000	719,000	– 23,000	16,885,000	16,901,000	– 16,000
Merchandise, &c. ...	391,000	474,000	– 83,000	14,460,000	15,547,000	– 1,087,000
Coal and coke ...	224,000	230,000	– 6,000	7,947,000	8,139,000	– 192,000
Goods-train traffic ...	615,000	704,000	– 89,000	22,407,000	23,686,000	– 1,279,000
Total receipts	1,311,000	1,423,000	– 112,000	39,292,000	40,587,000	– 1,295,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	468,000	469,000	– 1,000	10,876,000	10,983,000	– 107,000
Merchandise, &c. ...	270,000	319,000	– 49,000	10,084,000	10,723,000	– 639,000
Coal and coke ...	216,000	234,000	– 18,000	7,548,000	7,841,000	– 293,000
Goods-train traffic ...	486,000	553,000	– 67,000	17,632,000	18,564,000	– 932,000
Total receipts	954,000	1,022,000	– 68,000	28,508,000	29,547,000	– 1,039,000
G.W.R. (3,737 mls.)						
Passenger-train traffic...	306,000	313,000	– 7,000	7,064,000	7,134,000	– 70,000
Merchandise, &c. ...	164,000	192,000	– 28,000	5,895,000	6,277,000	– 382,000
Coal and coke ...	94,000	102,000	– 8,000	3,418,000	3,545,000	– 127,000
Goods-train traffic ...	258,000	294,000	– 36,000	9,313,000	9,822,000	– 509,000
Total receipts	564,000	607,000	– 43,000	16,377,000	16,956,000	– 579,000
S.R. (2,148 mls.)						
Passenger-train traffic...	433,000	442,000	– 9,000	10,554,000	10,622,000	– 68,000
Merchandise, &c. ...	58,000	64,000	– 6,000	1,910,500	1,980,500	– 70,000
Coal and coke ...	26,000	26,000	—	951,500	971,500	– 20,000
Goods-train traffic ...	84,000	90,000	– 6,000	2,862,000	2,952,000	– 90,000
Total receipts	517,000	532,000	– 15,000	13,416,000	13,574,000	– 158,000
Liverpool Overhead ... (6½ mls.)	1,523	1,505	+ 18	44,176	41,604	+ 2,572
Mersey (4½ mls.) ...	4,027	3,873	+ 154	139,800	134,113	+ 5,687
*London Passenger Transport Board ...	526,000	529,400	– 3,400	3,944,300	3,913,600	+ 30,700
IRELAND						
Belfast & C.D. pass. (80 mls.)	4,748	4,345	+ 403	82,227	85,629	– 3,402
,, ,, goods	427	375	+ 52	13,662	15,677	– 2,015
,, ,, total	5,175	4,720	+ 455	95,889	101,306	– 5,417
Great Northern pass. (543 mls.)	17,350	17,700	– 350	345,150	351,150	– 6,000
,, ,, goods	9,150	8,900	+ 250	280,800	301,500	– 20,700
,, ,, total	26,500	26,600	– 100	625,950	652,650	– 26,700
Great Southern pass. (2,076 mls.)	56,937	57,399	– 462	1,149,269	1,145,459	+ 3,810
,, ,, goods	38,238	37,614	+ 624	1,236,921	1,293,651	– 56,730
,, ,, total	95,175	95,013	+ 162	2,386,190	2,439,110	– 52,920

* 7th Week (before pooling)

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices Aug. 17, 1938	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	67⅜	55¾	37½	–½
5% Con. Prefce. ...	127	108	99½*	–1
5% Red.Pref.(1950)	113	109	99½*	–3
4% Deb.	113⅝	102½	106	–½
4½% Deb.... ...	118	106	108½	—
4½% Deb.	124½	112	113½	—
5% Deb.	136½	122¾	127½	—
2½% Deb.... ...	76	64	66½	—
5% Rt. Charge ...	133 7/16	118	120½	—
5% Cons. Guar. ...	133¾	116½	113½*	–2
L.M.S.R.				
Ord.	36⅛	25⅜	13¾	+¼
4% Prefce. (1923)	82½	65¾	30	–½
4% Prefce. ...	92½	77¾	56*	–½
5% Red.Pref.(1955)	107¾	102	78½	–2
4% Deb.	108	99¼	101	—
5% Red.Deb.(1952)	117½	111	112½	—
4% Guar. ...	104	95⅞	87½*	–1
L.N.E.R.				
5% Pref. Ord. ...	12½	6¾	4¼	—
Def. Ord.	6¼	3⅝	2⅝	+⅛
4% First Prefce.	79½	63	27	+½
4% Second Prefce.	31½	21	10½	—
5% Red.Pref.(1955)	101¼	89¾	49½	—
4% First Guar. ...	103	91⅞	77½*	–1½
4% Second Guar.	97⅝	85½	63½*	–1
3% Deb.	84⅛	74	72½	—
4% Deb.	107¼	98½	98½	—
5% Red.Deb.(1947)	113½	106½	109½	—
4½% Sinking Fund Red. Deb.	110 3/16	105½	107	—
SOUTHERN				
Pref. Ord.... ...	98⅝	83½	54½*	–2
Def. Ord.	27⅞	16¾	13½	–¼
5% Pref.	126 16/16	105 13/16	99½*	—
5% Red.Pref.(1964)	118	110¼	107*	–2
5% Guar. Prefce.	133¾	116¾	115½*	–2
5% Red.Guar.Pref. (1957)	118½	111½	113½*	—
4% Deb.	112	101¼	105½	—
5% Deb.	135¾	123½	126½	—
4% Red. Deb. 1962–67	113	105	106½	—
BELFAST & C.D.				
Ord.	5	4	4	—
FORTH BRIDGE				
4% Deb.	106	99½	100½	—
4% Guar. ...	105¾	99	99½	—
G. NORTHERN (IRELAND)				
Ord.	11	5	3	—
G. SOUTHERN (IRELAND)				
Ord.	50	21½	20	—
Prefce.	61	34	13½	—
Guar.	94¾	69½	35	–5
Deb.	95	82⅛	70	—
L.P.T.B.				
4½% "A" ...	123¾	110½	118½	—
5% "A" ...	135	121½	128½	—
4½% "T.F.A." ...	108¾	104	106	—
5% "B" ...	125	114½	119½	—
"C"	99¾	75	73½	–½
MERSEY				
Ord.	42⅜	22	17	—
4% Perp. Deb. ...	103	96¾	99	—
3% Perp. Deb. ...	77⅝	74½	73½	—
3% Perp. Prefce.	68¾	61¼	65	—

* ex dividend

RAILWAY AND OTHER REPORTS

Oxford Canal.—It is proposed to pay an interim dividend of 3 per cent., less tax. This compares with 2 per cent. last year.

Tilling & British Automobile Traction Limited.—An interim dividend is declared of 4 per cent. free of tax, on the ordinary shares, against 5 per cent., less tax, last year. The interim is payable on September 1.

Letterkenny Railway.—For the half-year to December 31, 1937, profit is reported of £1,287, against £1,200 in corresponding half-year. Interest on first and third mortgages is £1,046 (same), while the debit brought in is £29,428 against £29,617 and the carry forward debit is £29,187 compared with £29,463.

Union Minière du Haut-Katanga.—For the year 1937 the profit was 409,592,158 Belgian francs, and a dividend of 134 fr. per share was paid. On the shares of the Chemin de fer du Katanga, one of the subsidiary undertakings in the Congo, a dividend of 6·4 per cent. was paid on the ordinary shares.

The Pondicherry Railway.—The net profit of the railway (which is worked by the South Indian Company) to March 31 was Rs. 26,414. The company's portion, Rs. 13,207, realised £994, in comparison with Rs. 19,309, realising £1,461 in the corresponding period. The final dividend of 15 per cent. making 20 per cent. tax free, is the same as was declared in the previous year.

Aldershot & District Traction Co. Ltd.—Traffic receipts of this company, which is controlled jointly by Tilling & B.A.T. and the Southern Railway, were rather less for the year to May 31, 1938, the total being £334,690, as compared with £343,915 in the previous period. Adding the investment income of £3,207 (against £3,452), and deducting operating expenses £204,174 (against £205,298), duties, rates and taxes, and staff pensions, and again carrying £10,000 to reserve, the net profit of £17,000 compares with £18,750, and the dividend is maintained at 8 per cent.

Bengal & North Western Railway.—The accounts for the half-year ended March 31, 1938, show that the company's share of net earnings was £406,774, against £451,676 for the corresponding period last year, which together with £113,986 brought forward and £2,055 gain in exchange, makes a total of £522,815. An interim dividend is declared of 4 per cent. together with a bonus of 4 per cent., or 8 per cent. in all, for the half-year, leaving £138,872 to be carried forward. There was a decrease in the gross earnings of the open system of Rs.10,97,591 compared with the corresponding half-year of 1937, as, although coaching receipts increased by Rs.29,000, goods receipts were lower by Rs.11,77,603, or 9·72 per cent., mainly due to a light sugar-cane crop and a falling off in the tonnage of rice. Working expenses increased by Rs.1,19,386 and the operating ratio was higher by 3·03 per cent.

Crosville Motor Services Limited.—The accounts for the year ended April 30, 1938, of this subsidiary of the L.M.S.R., G.W.R., and Tilling & B.A.T. show a profit, after providing for depreciation, of £109,490, against £103,827 in the corresponding period last year. After carrying £20,000 to reserve, the same as in the previous period, a final dividend is declared of 4½ per cent., making 8 per cent. for the year, as in 1937.

Vera Cruz Terminal Company.—Gross receipts to June 30, 1937, being 1,655,667 pesos, and expenses 2,011,972 pesos, there is a deficiency of 356,305, which at exchange 18 pesos = £1, equals £19,795, compared with £66,755 in the previous period. Adding the service of the 4½ per cent. debentures, £48,075, and other liabilities, makes the deficit £75,387, less credit by proceeds from sale of Mexican Government coupons £5,781 and exchange differences, leaves a net debit of £69,492, against a net credit of £9,011. Debit forward is £1,772,618.

São Paulo-Parana Railway.—Gross receipts for the year 1937, according to the report of Parana Plantations Limited, owner of the railway, increased by 45 per cent. Goods carried increased by 47 per cent. and passengers by 12 per cent. The revenue account, after providing for normal upkeep, but before charging interest on advances or appropriations to reserves, showed a credit balance of 2,556 contos, or say, £29,200, as compared with 984 contos, or say £12,000 at the then rate of exchange, for 1936. The ratio of expenditure to receipts had fallen from 76·77 per cent. in 1936 to 58·28 per cent. in 1937. A new tariff has been approved by the government and came into force on June 1.

Rohilkund & Kumaon Railway.—For the half-year ended March 31 the company's share of net earnings was £64,629 (against £81,541), which, together with £21,451 brought forward from the previous period and other items of income, makes a total of £103,266. After providing for United Kingdom taxes, debenture interest, and preference dividends, and for the Secretary of State's share of surplus profits, the directors declare an interim dividend of 4 per cent. and a bonus of 4 per cent., or 8 per cent. in all, leaving £30,811 to be carried forward. Compared with the previous half-year there was a decrease of Rs.2,00,916, or 4·96 per cent., in the total gross earnings of the open system. Coaching receipts increased by Rs.1,330, or 0·11 per cent., but goods receipts fell by Rs.2,61,487, or 9·93 per cent., mainly due to a poor sugar-cane crop compared with a record one. Working expenses increased by Rs.1,47,017, and the ratio of working expenses to gross earnings was 5·92 per cent. higher.

Hurst, Nelson & Co. Ltd.—It is proposed to pay a dividend for the year to mid-July last of 2s. a share, or 10 per cent., and to place £10,000 to general reserve. For the previous year the dividend was 7½ per cent.

Chilean Northern Longitudinal Railway.—The report for the year 1937 shows that gross receipts amounted to £54,568, against £42,175 for the previous year. The amount in the hands of the trustees available for the second payment on 5 per cent. first mortgage debentures was £10,020, of which £8,693 is distributed at rate of 12s. 11d. per £100 debenture, for two half-years ended December 31, 1932, and June 30, 1933. The total amount due to the Antofagasta Company is now £336,963.

Tata Iron & Steel Company.—Net profits for the year ended March 31 amounted to Rs. 2,83,46,065 (about £2,126,000) an increase of Rs. 99,89,600 (£749,000). The dividend on the ordinary capital is raised to 20⅔ per cent., from 13¾ per cent., and the deferred shares will receive Rs. 75,11,3 per Rs. 30 share, as against Rs. 36,3,6. The improved earnings are attributed to the rise in the price of steel and increased efficiency of the works, as a result of heavy capital expenditure incurred of late years.

A.R.P. on the L.N.E.R.

The L.N.E.R. has now completed the equipment of a mobile instruction unit for the training of its staff in A.R.P. measures. The coach used was built as a first class dining car at Doncaster works some years ago and although its external appearance is very much the same, instead of the words "Restaurant Car" it now bears the legend "A.R.P. Instructional Unit" on each side. The vehicle is 62 ft. long and is divided into five sections, namely, an undressing room; washing and bleach treatment room; boiler room, with lavatory facilities; dressing room; and store room. It can now be used as a lecture and demonstration centre for the training of staff, whilst in emergency it fulfils Home Office stipulations as a cleansing centre.

The lecture room (which can also be used as a dressing room), the most spacious compartment of the vehicle, is 25 ft. long. It provides accommodation for 30 trainees and in this compartment special instruction will be given to the L.N.E.R. staffs at the various centres. A separate vehicle will travel with the mobile unit whilst it is used for training purposes. Here the instructor will put up the gas cloud. When not in use for gas chamber purposes, it will accommodate additional decontamination equipment. The vehicle was inspected by the company's officers in the yard adjoining King's Cross station on Wednesday and Thursday last.

OFFICIAL NOTICES

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for :—

(*a*) 294 STEEL TYRES FOR LOCOMOTIVES (150 BROAD GAUGE and 144 METRE GAUGE).

(*b*) 744 HELICAL and 2,150 VOLUTE SPRINGS.

Specifications and Forms of Tender can be obtained from the Company's Offices, 123, Victoria Street, Westminster, London, S.W.1.

Fee ONE GUINEA each, *which will not be returned*.

Tenders must be submitted not later than 2 o'clock p.m. on TUESDAY, 6th SEPTEMBER, 1938.

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right of reducing or dividing the orders.

By Order of the Board,
V. CRASTER,
Secretary.

THE Proprietors of Patent No. 382698, for "Improvements in or relating to Rail Seatings," are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for purpose of exploiting same and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to: HASELTINE, LAKE & COMPANY, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

CONTRACTS AND TENDERS

J. Mowlem & Co. Ltd. has received a £120,000 contract from the London Passenger Transport Board for the lengthening of 13 additional platforms on the Bakerloo Line in readiness for the running of longer trains when the extension to Stanmore is brought into use next year. This and other extensions and developments forming part of the £40,000,000 programme are referred to in greater detail in our news section elsewhere in this issue.

Improvements to L.N.E.R. Locomotive Depots

The L.N.E.R. has recently let several contracts for various improvements at certain principal locomotive depots, as follow :—

W. Wright & Son (Lincoln) Ltd. has been awarded the contract, valued at £2,000, for the extension of the general stores in which spare locomotive parts and materials such as lamp oil, and sponge cloths, will be kept at Lincoln depot.

Longden & Son has been given the contract for the construction of locomotive inspection pits at Darnall, near Sheffield, where the L.N.E.R. is constructing a new locomotive depot in connection with the Manchester-Sheffield electrification scheme, to provide accommodation for both steam and electric locomotives.

Longden & Son has also been awarded a contract for building dormitories at Darnall new locomotive depot which will be available for enginemen who have to spend a night away from home. The value of these contracts is £30,000.

Haymills Limited has received a contract for the rebuilding of the locomotive sheds at Darlington. This locomotive depot, which has associations with the earliest public railways in the country, will, when complete, be one of the most up to date on the L.N.E.R. A mechanical coaling plant, new engine disposal pits, up-to-date repairing equipment, together with new offices and a new mess-room, are all included in this modernisation scheme, and the turntable is to be replaced by one of 70-ft. dia. to deal with the larger engines in use today.

D. Wickham & Co. Ltd. has received orders from the Uruguay State Railways for one No. 8A petrol-driven inspection trolley and from the Antofagasta (Chile) & Bolivia Railway for six No. 17A petrol-driven motor gang trolleys.

The South Indian Railway Administration has placed the following orders to the inspection of Messrs. Robert White & Partners :—

Taylor Bros. & Co. Ltd. : 159 carriage and wagon tyres and 40 locomotive tyres.

The General Electric Co. Ltd. : 2,900 electric lamps.

Baldwin Locomotive Works : 22 electric headlight turbo generators.

Karrier Motors Limited has received orders through Rootes Limited from the South African Railways & Harbours Board for a further 100 Cob Junior 4-ton tractor units with standard chassis except for the tyre units and with Karrier BK type automatic coupling gear, which leaves the trailer supported at two extreme points at the front end.

The Crown Agents for the Colonies have recently placed the following orders :—

Sturtevant Engineering Co. Ltd. : Air cooling plant.

Babcock & Wilcox Limited : Boiler equipment.

Ismay Cables Limited : Cable.

Britannic Electric Cable & Construction Co. Ltd. : Cable.

T. Bolton & Sons Ltd. : Copper ingots.

John Watts (Burnley) Limited : Cotton waste.

A.B.C. Coupler & Engineering Co. Ltd. : Coupler spares.

Imperial Chemical Industries Limited : Detonators.

Merryweather & Sons Ltd. : Fire extinguishers.

Baldwins Limited : Galvanised corrugated m.s. sheets.

Barrow Hematite Steel Co. Ltd. : Fishplates.

Wolverhampton Corrugated Iron Co. Ltd. : Galvanised corrugated steel sheets.

Whitecross Co. Ltd. : H.D. copper wire.

British Insulated Cables Limited : Insulated cable.

J. Baker & Bessemer Limited : Locomotive tyres.

Steel, Peech & Tozer, United Steel Cos. Ltd. : Locomotive tyres.

The Egyptian State Railways Administration has placed the following orders :—

S.A. Forges, Usines & Fonderies à Haine St. Pierre : Leading and driving locomotive wheels. [Order No. 21.835, total cost £375 11s., delivery f.o.b. Antwerp.]

Klockner & Co. : Tyres. [Ref. No. E.S.R 21.838, total price £236 5s., delivered Gabbary Quay, Alexandria.]

Staveley Coal & Iron Co. Ltd. : Pipes. [Ref. No. E.S.R. 17.255, total cost £837 12s. 5d., free delivery Gabbary Quay.]

Cie. Générale d'Electro Metallurgie : Copper line wire. [Order No. 30.435, total price £228 2s., delivered La Havre.]

Tenders are invited by the Chief Controller of Stores, Indian Stores Department (Engineering Section), Simla, receivable by September 7, for the following machine tools and equipment required for the N.W. Railway at Moghalpura :—

Three electrically-driven punching machines.

One nibbling shears and punching machine.

One self-contained medium duty radial drilling machine.

One electrically-driven vertical-spindle surface grinding machine.

One cold sawing machine complete with motor.

One high-power universal milling machine complete with motor.

One burnishing machine, electrically-driven.

Two electrically-driven axle journal lathes.

One electrically-driven carriage and wagon tyre boring and turning machine.

One high-power universal milling machine.

One trimming press, motor-driven.

One universal milling machine with belt drive.

One engraving machine complete with belt drive.

One oil-fired furnace for heat-treating tools.

One horizontal-spindle surface grinder.

Tenders are invited by the Egyptian State Railways Administration, receivable at the General Management, Cairo station, by August 30, for the supply of 205,300 kg.. round mild steel.

Tenders are invited by the Egyptian State Railways Administration, receivable at the Stores Department, Saptieh, Cairo, by September 13 for the supply of 70,000 kg. mild steel flat bar ; receivable by September 17, for 37,500 kg. ribbed and 875 kg. unribbed steel flat bar for laminated springs ; and receivable by September 24, for the supply of 19,040 kg. round copper bar.

Railway Share Market

The general position in the stock and share markets has been governed this week by the tension in European politics. Business has continued at a very low ebb and values in most sections of the Stock Exchange have declined, although this was again attributed mainly to the small amount of business in evidence. No very heavy selling has been reported, and markets appear to have shown a firmer undertone than seemed likely at the beginning of the week.

Home railway stocks could hardly be expected to move against the general trend, bearing in mind the continued decline in traffics. The figures for the past week, which show a decline of £238,000, led to selling, not only of the junior stocks, but also of some of the guaranteed and senior preference securities, although, with the possible exception of L.N.E.R. 4 per cents., there is, of course, every reason to believe that the guaranteed dividends will be paid in full for the current year. Senior preference stocks also made reduced prices in sympathy with the surrounding tendency, and in many cases they would appear to be moderately valued, although unless traffics improve, and markets as a whole become more active, it appears quite possible that still lower prices may be seen. Great Western ordinary has moved down to 37½ because on present indications it would seem there are possibilities of only a very small dividend this year if the directors are not prepared to draw on reserves. The 5 per cent. preference has changed hands around 99. Southern preferred and deferred at 54½ and 13¼ respectively were affected by the continued absence of the hoped-for improvement in passenger traffic, while the 5 per cent. preference was around 99, and the 5 per cent. guaranteed stock at 116 has also made a lower price. L.M.S.R. ordinary at 14 was steadier than most other junior securities, and the 4 per cent. preference at 55½ was assisted by the growing belief that there are reasonable prospects of the dividend being paid in full. On the other hand, the 4 per cent. 1923 preference is now slightly below 30. The 4 per cent. guaranteed has made the lower price of 87. L.N.E.R. 4 per cent. first and 4 per cent. second guaranteed stocks declined further to 78 and 63 respectively, while the first preference moved down further to 26½ and the second preference to around 10. Debenture stocks generally were steady, although L.N.E.R. 4 per cents. lost a point to 98. London Transport "C" transferred around 73½.

Argentine railway securities were reactionary. This was attributed very largely to the influence of market conditions, but some selling of the debentures was reported. B.A. Gt. Southern 4 per cent. debentures are 64, Central Argentine 5 per cents. 66½ and B.A. Pacific consolidated debentures 34½. Elsewhere, Nitrate Rails and San Paulo ordinary stocks reflected the movement to lower levels. American railway stocks tended to improve, including Atchisons, Southerns, and Union Pacifics. Canadian Pacific were little changed at 6⅝.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1937-38	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1937	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1937	Prices: Lowest 1937	Prices: Aug. 17, 1938	Prices: Yield (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Bolivia	834	14.8.38	19,910	+ 4,610	33	502,900	533,190	− 30,290	Ord. Stk.	29	10¼	12	Nil
	Argentine North Eastern	753	13.8.38	11,371	+ 999	7	73,902	66,582	+ 7,320	,,	18¼	6	6	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	93½	60	80	5
	Bolivar	174	July, 1938	3,650	− 2,150	30	26,250	40,800	− 14,550	6 p.c. Deb.	9½	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	17	9	6	85/16
	Buenos Ayres & Pacific	2,806	13.8.38	74,566	− 6,017	7	465,386	527,792	− 62,406	Ord. Stk.	17⅛	5½	5	Nil
	Buenos Ayres Central	190	30.7.38	$121,600	− $30,200	5	$526,800	$693,100	− $166,300	Mt. Deb.	41½	18	14	Nil
	Buenos Ayres Gt. Southern	5,084	13.8.38	127,481	+ 7,506	7	790,509	782,320	+ 8,189	Ord. Stk.	33¾	13½	12	Nil
	Buenos Ayres Western	1,930	13.8.38	40,136	− 10,795	7	242,058	293 611	− 51,553	,,	31¾	11¼	7½	Nil
	Central Argentine	3,700	13.8.38	108,676	− 28,411	7	658,447	933,330	− 274,883	,,	34¼	10¾	8	Nil
	Do.	—	—	—	—	—	—	—	—	Did.	20½	4½	4½	Nil
	Cent. Uruguay of M. Video	972	6.8.38	16,743	+ 1,516	6	89,684	85,208	+ 4,476	Ord. Stk.	67/32	2	2	Nil
	Cordoba Central	1,218	—	—	—	—	—	—	—	Ord. Inc.	6¼	1½	3½	Nil
	Costa Rica	188	June, 1938	31,369	+ 318	52	314,399	249,333	+ 65,066	Stk.	38	27	25½	7/16
	Dorada	70	July, 1938	18,900	+ 3,800	31	114,600	105.500	+ 9,100	1 Mt. Db.	107	106	105	5/16
	Entre Rios	810	13.8.38	16,768	+ 2,134	7	100,545	91.656	+ 8,889	Ord. Stk.	19/16	6	5½	Nil
	Great Western of Brazil	1,092	13.8.38	5,300	− 1,300	33	211,500	237,800	− 26,300	Ord. Sh.	5/4	1/8	1/4	Nil
	International of Cl. Amer.	794	June, 1938	$425,611	+ $9,637	26	$3,010,489	$3,126,388	− $115,899	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	2/-	1/-	1/2	Nil
	La Guaira & Caracas	22§	July, 1938	5,345	+ 930	31	35,580	38,120	− 2,540	Stk.	8½	6	8½	Nil
	Leopoldina	1,918	13.8.38	22,912	− 2,701	33	616.635	735.044	− 118,409	Ord. Stk.	9¼	3	2	Nil
	Mexican	483	7.8.38	$218,400	− $16,700	6	$1,480.300	$1,590.200	− $109,900	,,	1½	1/4	5/16	Nil
	Midland of Uruguay	319	July. 1938	8.682	+ 1,041	4	8,682	7,641	+ 1,041	,,	1⅞	1/2	1/2	Nil
	Nitrate	386	15.8.38	5,852	+ 230	33	96,357	100,988	− 4,631	Ord. Sh.	31/16	2	2	5
	Paraguay Central	274	6.8.38	$3 866,000	+ $451,000	6	$18,648,000	$19,937,000	− $1,289,000	Pr. Li. Stk.	84	79¼	57½	5/16
	Peruvian Corporation	1,059	July, 1938	74,055	− 7.079	5	74,055	81,134	− 7.079	Pref.	14¾	4½	3¼	Nil
	Salvador	100	6.8.38	¢13,370	− ¢2,030	6	¢61,993	¢70,052	− ¢8,059	Pr. Li. Db.	23½	21½	22½	Nil
	San Paulo	153½	7.8.38	31,159	− 3.074	32	990.867	1,032,782	− 41,915	Ord. Stk.	98½	56	36	1/8
	Taltal	160	July, 1938	3.510	+ 570	4	3,510	2,940	+ 570	Ord. Sh.	17/16	11/16	5/4	135/16
	United of Havana	1,353	13.8.38	16.200	− 4,528	7	102.414	122,741	− 20,327	Ord. Stk.	56/8	51/32	1½	Nil
	Uruguay Northern	73	July, 1938	874	+ 86	4	874	788	+ 86	Deb. Stk.	10	2	2	Nil
Canada	Canadian National	23,781	7.8.38	643,001	− 61,404	32	20,030,256	23,036,265	− 3,006,009	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	77	62½	63½	5/16
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	101⅞	94½	101½	31/16
	Canadian Pacific	17,186	7.8.38	511,000	− 5,400	32	14,986,600	16,282,800	− 1,296,200	Ord. Stk.	18	7¼	6½	Nil
India†	Assam Bengal	1,329	31.7.38	38,525	− 2,487	18	453,918	433,356	+ 20.562	Ord. Stk.	86	73½	78	31/16
	Barsi Light	202	31.7.38	2,587*	− 653	18	55.057	49.740	+ 5,317	Ord. Sh.	66½	46	60	5/16
	Bengal & North Western	2,116	31.7.38	71,086	− 11,077	18	1,004,313	1,062,012	− 57,699	Ord. Stk.	317	301	287½	6¼
	Bengal Dooars & Extension	161	31.7.38	4,412	+ 41	18	43,829	43,371	+ 458	,,	100	84	85½	7
	Bengal-Nagpur	3,268	31.7.38	164,100	− 18.061	18	2,349,167	2,410.989	− 61.822	,,	101	89	92	4⅝
	Bombay, Baroda & Cl. India	3,085	10.8.38	201,000	+ 12,525	19	3,207.450	3,275.925	− 68,475	,,	113	110½	110½	5/16
	Madras & Southern Mahratta	2,937	20.7.38	145,275	+ 15,527	16	1,808.073	1,708.547	+ 99,526	,,	110	105	107	3/16
	Rohilkund & Kumaon	546	31.7.38	12,818	− 250	18	200.293	206,323	− 6,030	,,	314	302	296½	6/16
	South Indian	2,531§	20.7.38	114,470	+ 3,099	16	1,301,705	1,291,012	+ 10,693	,,	103½	99½	101½	41/16
Various	Beira-Umtali	204	June, 1938	89.780	− 1,725	40	783,061	676,896	+ 106,165	—	—	—	—	—
	Egyptian Delta	620	31.7.38	6,075	− 617	18	66,549	70,932	− 4,383	Prf. Sh.	31/-	5/4	5/4	Nil
	Kenya & Uganda	1,625	June, 1938	216,938	+ 28,675	26	1,498,289	1,524,339	− 26,050	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb	48⅛	43½	43	8⅛
	Midland of W. Australia	277	June, 1938	15,962	+ 4,994	52	180,120	155,207	+ 24,913	Inc. Deb.	98	93½	93½	4¼
	Nigerian	1,900	2.7.38	28,714	− 8,045	14	407,837	754,205	− 346,368	—	—	—	—	—
	Rhodesia	2,442	June, 1938	425,403	+ 5,522	40	3,743.259	3,352,058	+ 391,201	—	—	—	—	—
	South Africa	13,263	30.7.38	624,507	− 28,741	18	10,620,941	10,853,287	− 232,346	—	—	—	—	—
	Victoria	4,774	May, 1938	849,379	+ 26,441	48	9,015,865	9,342,068	− 326,203	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

* Ashadi fair. † Receipts are calculated @ 1s. 6d. to the rupee § ex dividend.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value

Electric Railway Traction

Urban Electric Railway Capacity

THE apparently ever-increasing schedule speed of urban surface and underground trains, resulting from the necessity of increasing the carrying capacity of the system, has led within the last few years to intensive study of the acceleration and retardation problems. The automatic air brake has been superseded by the electro-pneumatic type, and on certain railways by eddy-current or regenerative brakes. Even at the speeds met with in the various urban railways, say 45 m.p.h. as a maximum, the drop in brake block friction with decreasing speed is appreciable, and the Westinghouse electro-pneumatic brake is now used in conjunction with a retardation controller so that the maximum permissible braking force can be used right down the scale. As with the deceleration, the acceleration also is controlled by the adhesion conditions, and it is to get a uniform maximum rate of acceleration right up the speed range that multi-notch and notchless (*e.g.*, the metadyne) control systems have been introduced. As far as passenger comfort is concerned, it is not the rates of acceleration or deceleration which are responsible for the cursing and letters to the management, but the rate of *change*, and the systems of control and braking just mentioned are advantageous in this respect. Another important factor influencing the capacity of a line is the duration of the station stop, and in a paper recently read at a meeting of the Operating Department staff of the L.P.T.B., Mr. H. R. Broadbent, of the Chief Mechanical Engineer's Department, emphasised that an increase of 2¼ sec. in the station stops meant a loss of one train an hour with a headway of 90 sec. (40 trains an hour), and the same loss occurred if with a headway of 75 sec. (48 trains an hour) the station stops were increased by 1½ sec. Mr. Broadbent said that by an improvement in the door air-motor design and by the provision of a door valve to each pair of double doors and every single door, the door opening time had been reduced from four seconds to two seconds in the newest underground trains. Further advance had been made by increasing the size of the door openings per car side, and by automatic closing of the doors, which always produced a psychological effect on the passengers which made for shorter station stops. On the present seven-car tube trains the full door opening averaged 10 ft. 3 in. per car and this had been increased to 12 ft. 2 in. on the new stock. From an average of 9 ft. 10¾ in. on the existing District line stock the door opening per car side had been increased to 11 ft. 3 in. on the new surface line stock. By placing more, or all, of the control equipment below the floor level, the square feet of space available for passengers in a seven-car tube train had been increased from 2,382 to 2,866, an advance of 20 per cent. One further method of obtaining maximum carrying capacity may be mentioned. It is to insist that all the trains in operation have accelerative and decelerative powers and aids to rapid loading and unloading equal to those of the best and newest train on the line. Two or three old trains can make a difference on the wrong side during peak traffic periods and it is rarely possible to arrange for them to be away from the densest traffic area.

86 m.p.h. Schedule in Italy

DESPITE the extent of railway electrification in Europe, it is only in a very few instances that the speed potentialities of electric tractors are anything like fully exploited, but the average of 86½ m.p.h. introduced on July 27 with a booking of 90 min. for the 129½ miles from Rome to Naples (Mergellina) means that the triple-car trains of the Italian State Railways are being extended just about as far as seems desirable for an everyday service on taking all considerations into account. The work required by this schedule is intensified at the moment by the extensive rearrangement of the approach lines at Rome (Terminus) and by bridge strengthening between there and Campo Leone, which together mean a loss of at least five minutes. On a northbound run with one of the Breda triple-car streamlined trains just before the recent acceleration, the overall time from Naples (Mergellina) to Rome was 111 min. dead, or 1 min. under schedule, despite p.w. slacks to 30 m.p.h. at Priverno, to 5 m.p.h. near Santa Palombo, and to 5-7 m.p.h. for two minutes approaching Rome, and with the usual running at reduced speed through Villa Literno and Formia. This average speed of 70 m.p.h. was maintained without the speed at any point exceeding 87 m.p.h. On the first day of the new schedule the southbound run was made in 84 min., an average of 92½ m.p.h. with a top speed slightly under 120 m.p.h., and the northbound trip in 96 min., an average of 81 m.p.h. As recorded in the issue of this Supplement for February 4 last, an average of 93·7 m.p.h. southbound was achieved on a trial run at the end of last year, but a top speed of over 124 m.p.h. was necessary. Although the alignment of the Rome—Naples direct route is eminently suited to high speeds, we believe that a somewhat higher standard of track maintenance will be necessary if 100 m.p.h. or over is to be attained every day. On our own run on the 112 min. schedule the riding in general was very good (and incidentally the air-conditioning functioned splendidly), but at speeds over 78 m.p.h. or so there were too many side shocks for complete comfort, and it is only to be expected that these will be intensified at higher speeds over the same track. Although these trains were originally first and second class (see issues of this Supplement for July 23 and August 20, 1937), those engaged on the Rapido service are now first class only. They run from Naples (P. Garibaldi) to Bologna, the schedule from Rome to Florence being 194 min. non-stop for the 196¼ miles, and from Florence to Bologna 52 min. for the 60¾ miles over the Direttissima. When the Bologna—Milan line is opened to electric traction at the end of October, the runs will be prolonged to Milan, instead of connecting with a steam train.

Electrification of Spanish Provincial Line Completed

80-*mile line worked entirely by motor-coaches*

AMONG the local electric lines in the north of Spain is the Vasconavarras Provincial Railways, a metre-gauge line running from Estella to Vitoria and Mecolalde. From Estella to Vitoria is 70 km. (43½ miles), and at the latter place the line crosses over the Norte main line just to the north of that company's station. The Provincial Railways' station adjoins that of the Norte, and there is another, the Ciudad, near the middle of the town. From Vitoria to Mecolalde is 63 km. (39 miles), and at Mecolalde the line joins with the Malgaza-Zumarraga branch of the Vascongados Railway, which like the Vasconavarras Provincial line, is electrified at 1,650 volts d.c.

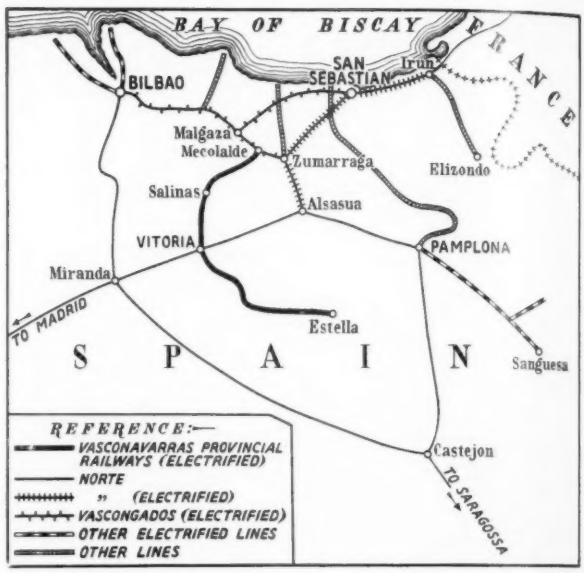
Conversion by German Firm

There are numerous curves, with a minimum radius of 200 m. (65 ft.) throughout the line, and on the Vitoria—Mecolalde line the gradients are as steep as 1·9 per cent. (1 in 53). All passenger and freight trains are hauled by motor-coaches, and the train weights vary from 60 to 100 tons for passenger trains and up to 200 tons for freight trains. Electrification of the Estella—Vitoria section was carried out in 1929 by the Siemens-Schückertwerke, the substation equipment being supplied by Brown Boveri. In 1935 conversion of the Vitoria—Mecolalde section was begun, and in the following year the Vitoria—Salinas portion was opened to electric traction. Owing to the civil war work on the remaining portion was suspended, but in 1937 was resumed under the Franco administration, and the Salinas—Mecolalde section was opened to electric working a few weeks ago. Conversion work was here again carried out by the Siemens-Schückertwerke, the substation equipment being supplied by the Spanish-foreign organisation Geathom.

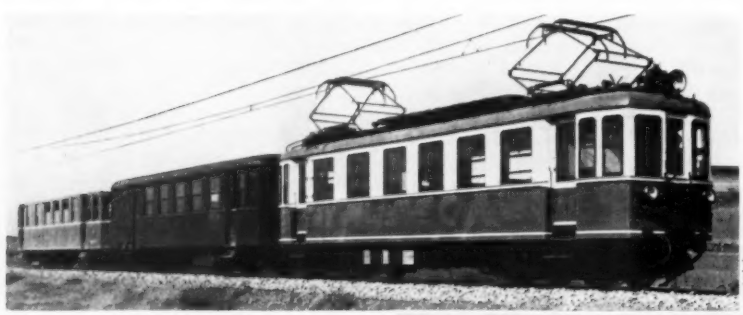
Through trains are not run between Estella and Mecolalde; Vitoria Norte is considered the centre and separate trains run from there to Estella and to Mecolalde. Usually there is a wait of one to two hours for the connecting train. The journey times vary from 84-85 min. for express trains to 105-121 min. for slow trains between Vitoria and Estella, and from 106-112 min. for express trains to 126-132 min. for slow trains between Vitoria and Mecolalde. The line is single track throughout.

Both passenger and freight motor-coaches are double-bogie vehicles driven by four nose-suspended motors of the same type. The passenger cars seat 12 first class and 32 third class passengers; there is a small amount of luggage space alongside the driving compartment at each end of the car. The 850-mm. (33½-in.) wheels are spread over a base of 2·2 m. (7 ft. 3 in.) and the pivots are 8·16 m. (26 ft. 9 in.) apart; over headstocks the length is 13 m. (42 ft. 7 in.). Two types of buffing and draw-gear are carried on the underframe, viz., a simple centre coupler at a height of 750 mm. (29½ in.) and a screw coupling at a height of 560 mm. (22 in.).

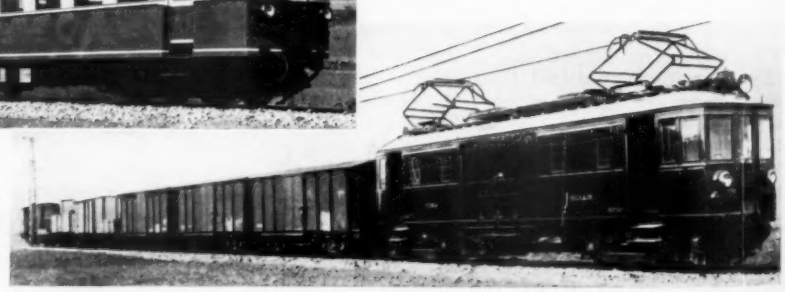
Each motor has a one-hour rating of 55 kW. at 630 r.p.m. with full field and a voltage of 750, this corre-



Map of railways in the old Spanish province of Vascongados near the French frontier



Left : 460-h.p. passenger motor-coach hauling two light bogie trailers on the Vitoria-Mecolalde line of the Vasconavarras Provincial Railways

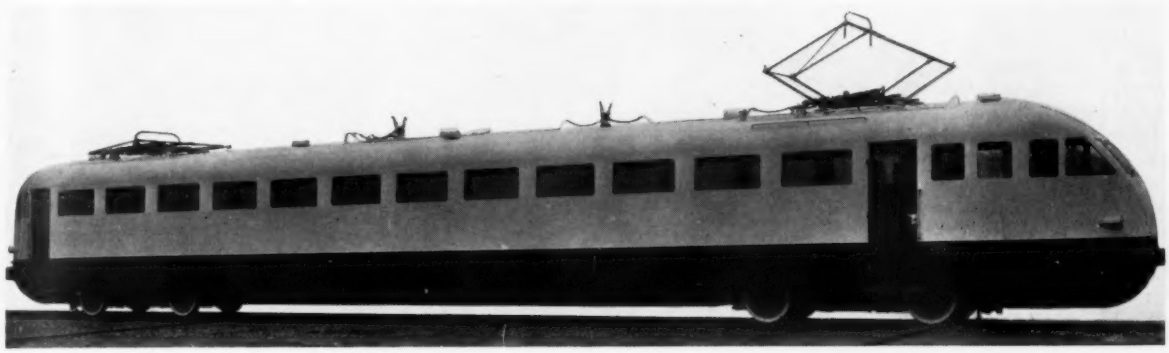


Right : Four-motor freight motor-coach at the head of a miscellaneous freight train

sponding to a nominal voltage of 1,500 in the overhead line, both motors on a bogie being permanently connected in series. On the continuous rating the output per motor is 37 kW. at 720 r.p.m. The latest cars used on the Vitoria—Mecolalde line have a one-hour rating of 86 kW. per motor. In the passenger vehicles the helical reduction gears have a ratio of 1:3·43 and in the freight motor-coaches 1:5·20, and with new wheels this gives respective speeds of 29·4 km.p.h. (18·2 m.p.h.) and 19·4 km.p.h. (12 m.p.h.) on the one-hour rating, and 33·5 km.p.h. (20·8 m.p.h.) and 22·2 km.p.h. (13·8 m.p.h.) on the continuous rating. Normally the maximum speeds are limited to 60 km.p.h. (37½ m.p.h.) for passenger trains and 40 km.p.h. (25 m.p.h.) for freight trains. Four contactors are used for grouping the motors in series or parallel and the resistances are cut in or out in 12 steps. The air brakes, two pantographs, and control gear are supplied with air by a 3·3 kW. Siemens motor-driven compressor set with a capacity of 400 litres a min. compressed to 8 atm. (115 lb. per sq. in.).

FAST MOTOR-COACHES FOR SOLO WORK IN ITALY

11 *h.p. per ton of gross weight gives high accelerative powers*



Standard 90-ft. 500-h.p. motor-coach, Italian State Railways

CONSIDERABLE use is now being made of light streamlined motor-coaches by the Italian State Railways on the 3,000-volt d.c. lines, and these vehicles are unusual in that they are operated solo or in pairs coupled in multiple-unit; they are not equipped in any way for trailer haulage. Most of these cars have been built by the Soc. It. Ernesto Breda.

These double-bogie cars seat 23 second class and 56 third class passengers on a tare weight of 37·5 metric tons and within an overall length of no less than 91 ft. The maximum axle load is about 11·5 metric tons when fully loaded, and the designed top speed is 75 m.p.h. Welded steel construction is used throughout the mechanical portion, and the body framing, shell, and underframe, which are fabricated as an integral structure, weigh together 10 metric tons. The accommodation includes, in addition to the two passenger saloons, two luggage rooms, a mail compartment, a lavatory, and two driving compartments. The interior panel plates are of aluminium and between the inner and outer sheets there is a layer of insulating material. All the windows are of safety glass, and certain of them can be raised and lowered. Welded steel construction is used also for the bogie framework. A swing bolster is incorporated in the design, with spring links outside the frames and double elliptical springs at each side. The wheels are of the solid disc type and the axleboxes are between the wheels and the inside frames. Compressed air brakes are embodied and apply two blocks on each wheel. No sanding gear is fitted.

The car is driven by four force-ventilated nose-suspended motors, but with a spring drive to the wheels. The motors are wound for 1,500 volts and the two on each bogie are connected permanently in series; they have an individual one-hour rating of 92 kW. at 1,020 r.p.m. The electro-pneumatic control equipment includes contactors for the insertion or withdrawal of the resistances from the main circuit and for connecting the motors in series-parallel or parallel; maximum current relays; a double acceleration relay; and two auxiliary relays. Two spring-controlled air-operated pantographs are fitted on the roof.

Auxiliary equipment includes a 24-volt 1·5 kW. motor-generator set; two 125 amp.hr. batteries coupled in parallel; a 24-volt motor-driven compressor set with a capacity of 220 litres of free air per min., and two further compressors of the same capacity; a 24-volt lighting installation and a 3,000-volt electric heating system comprising 16 one-kilowatt heaters in the passenger saloons and four 500-watt sets for the two driving compartments.

A typical instance of the use of these modern motor-coaches is on the line from Trieste Centrale to Gorizia and Udine, over which two-thirds of the trains serving this section only are now operated by these vehicles, frequently by two coupled in multiple-unit. Compared with the immediately preceding trains hauled by E.626 class Bo+Bo+Bo electric locomotives, the time taken is 92 min. as against 120 min. A large number of motor-coaches of the same general type is now under construction for use on more southerly sections of the Italian State Railways.

NEW YORK SUBWAY STOCK.—An experimental three-car articulated electric train has been ordered by the New York Rapid Transit Corporation. It is to be of aluminium, streamlined, and suitable for a higher speed than the normal stock, and to reduce noise will have rubber cushioned wheels and rubber springs. It is intended for use on the Brooklyn—Manhattan lines.

SWISS RACK RAILWAY ELECTRIFICATION

Direct current operation adopted on tourist line near Lake Geneva

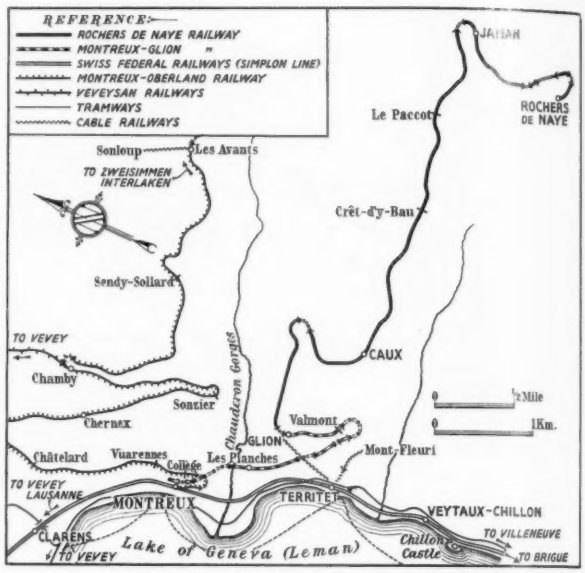
THE rack railway from Glion, above the Lake of Geneva, to the summit of the Rochers de Naye has just been electrified on the low tension d.c. system but with overhead current collection. The line is 7·6 km. (4·7 miles) in length, with a maximum gradient of 22 per cent., and is laid to the 80 cm. (31½ in.) gauge, as is also the 2·9-km. (1·8-mile) connecting line from Montreux (Federal Railways station) to Glion. The latter was electrically worked from its opening in 1909, and uses separate locomotives, which are placed at the lower end of the trains. All coaches on the Glion—Naye line run through to and from Montreux, while passengers from Territet use a cable railway and change at Glion.

The Rochers de Naye railway was opened in 1892. It has a considerable summer tourist traffic and is very popular with excursionists from all parts of French Switzerland. Winter sports also account for a substantial portion of the receipts, and a ski-lift was recently opened near the summit to cater for the "downhill only" fashion. The terminus is at an altitude of 6,500 ft. (1,973 m.) and commands a wonderful view over the lake and the Alps.

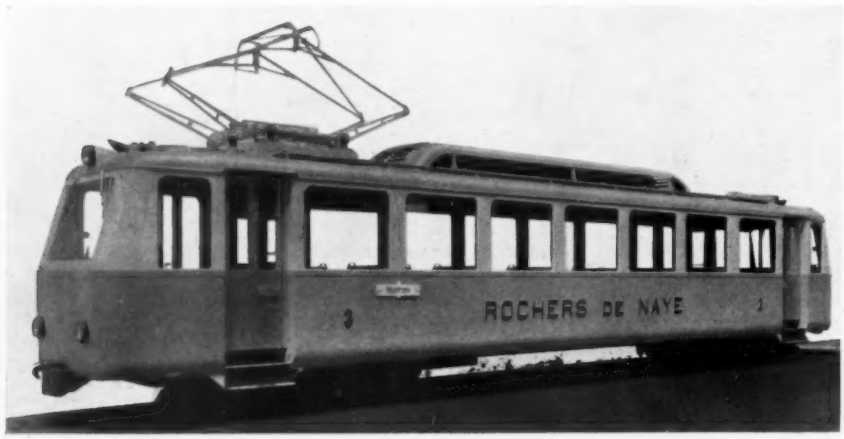
Lightweight Stock

Five lightweight railcars have been built, and they run through over the Montreux—Glion line; electric locomotives of the latter railway also work trains with the older type of coach to the Rochers de Naye. Power is being provided by the Entreprises Electriques Fribourgeoises from its transformer station at Chernex, above Montreux, where three-phase current at 32,000 volts 50 cycles is stepped down to 8,600 volts and supplied to a new automatic substation at Crêt-d'y-Bau (between Caux and Jaman), remotely-controlled from Caux station. This substation is equipped with two Brown Boveri mercury-arc rectifiers with a capacity of 400 kW. each, and from which current at 800 volts d.c. is fed to the overhead line.

The new railcars have a capacity of 52 seated and 18 standing passengers in two classes, and when necessary they push a small open wagon with accommodation for 10 passengers, or for skis in winter. The cars are 14·6 m. (48 ft.) in length, and tare approximately 14·7 *tonnes*. Each bogie is equipped with a traction motor, rack driving-wheel, and rack wheel for braking purposes. Each motor develops 102 h.p. at 2,080 r.p.m. at a speed of 12·3 km.p.h. (7·6 m.p.h.) on the one-hour rating. The total gear reduction is 18·25 : 1, and at the maximum motor speed of 3,000 r.p.m. the track speed is 17·8 km.p.h. (11 m.p.h.). The adhesion wheels have diameters of 653 mm. (25·8 in.) and 550 mm. (21·6 in.), and the rack wheels 573 mm. (22·5 in.). As compared with the previous trains, which tared 30 *tonnes*, and had a capacity of 60 passengers and a speed of 8 to 9 km.p.h. (5 to 5·6 m.p.h.), and took 86 min. from Montreux to the summit, the new railcars convey 80 passengers at 12 to 13 km.p.h. (7·5 to 8·1 m.p.h.) and take only about 50 min. for the trip. One-man control is provided. The electrical equipment of the railcars weighs about 3½ *tonnes* and was supplied by Brown Boveri & Co., Baden; the mechanical portion was built by the Swiss Locomotive & Machine Works, Winterthur.

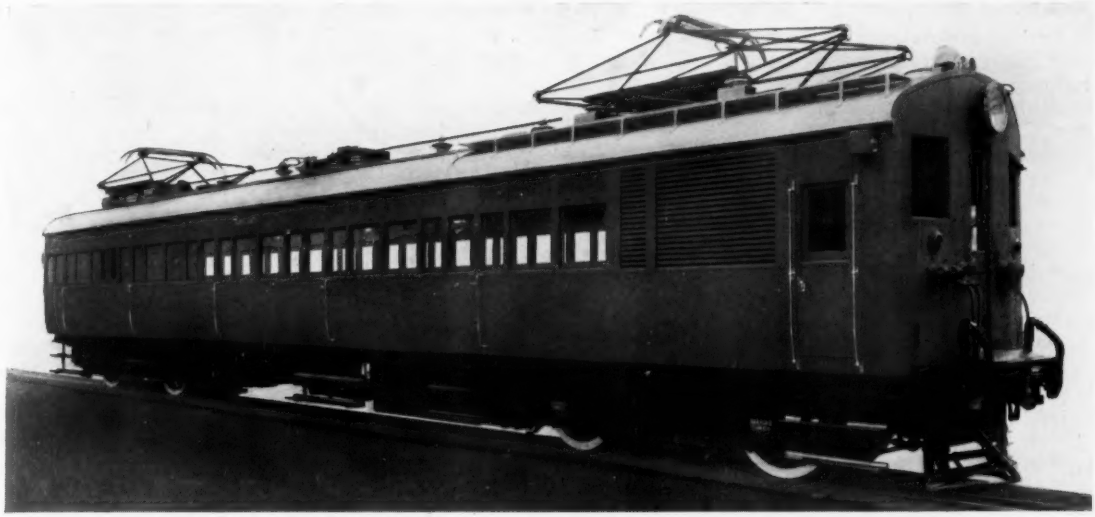


Map of the Rochers de Naye Railway showing its connections with the Swiss Federal and Montreux-Oberland Railways in the vicinity of Montreux



One of the 204-h.p. motor-coaches for the 800-volts d.c. electrified rack line of the Rochers de Naye Railway. On the one-hour rating, the coaches have 14 h.p. per ton of tare weight and 10 h.p. per ton of gross weight

NEW ELECTRIC STOCK FOR THE TRANSVAAL



3 ft. 6 in. gauge third class motor-coach of 1,160 h.p.

AMONG the large deliveries of electric stock to the South African Railways for operation over the newly-electrified lines are 82 double-bogie motor-coaches supplied by the Metropolitan-Cammell Carriage & Wagon Co. Ltd., of which 76 are in use on the Reef and Rand electrifications and the other six in Natal. These vehicles are of steel construction and were built at Met-Cammell's Old Park works at Wednesbury.

Certain motor-coaches have first class accommodation and the others third class, and in both types the seats are arranged in open saloons. In the former are 74 seats upholstered in green leather and in the latter 99 seats of varnished oak. The interior finish of the first class saloons is of varnished teak, and for the third class interior a painted finish in buff and brown has been adopted. All interior fittings are chromium plated and the external fittings are of stainless steel. The wheels have a diameter of 35½ in. and are spread over a bogie wheelbase of 8 ft. 6 in. Timken roller bearing axleboxes with journals 6⅞ in. by 4⅞ in. are used, and all wheels are braked on the vacuum system. The bogies are pitched at 41 ft. centres, and the cars have a length of 60 ft. 8 in. and are 62 ft. 11 in. over coupler knuckles; the tare weight is 56·7 tons. End doors and fall plates are used to get from one coach to another.

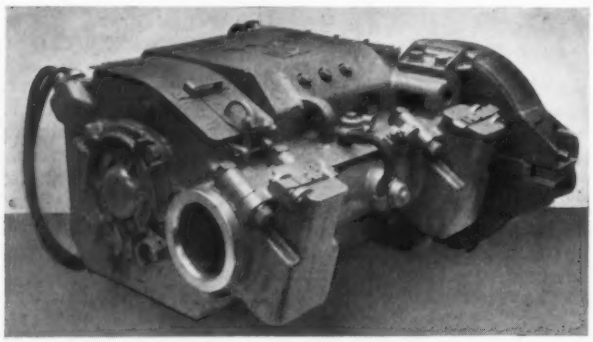
The electrical equipment was supplied by the American General Electric Company, and includes four nose-suspended traction motors with an individual one-hour rating of 290 h.p. Two pantographs collect the 3,000-volts d.c. from the overhead line. All the high-tension apparatus is housed in a chamber adjoining the driving compartment.

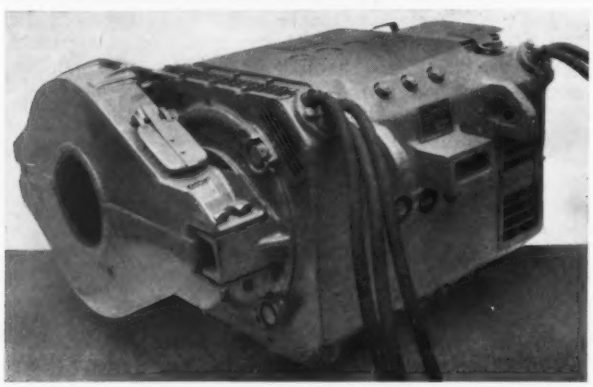
Interior of 9 ft. wide first class saloon in one of the 82 motor-coaches delivered to the South African Railways during the past 15 months

A Typical Modern Nose-Suspended Motor

THE traction motors used in the new 53 twin-car and 37 triple-car streamlined trains of the Netherlands Railways, which were described in the issue of the *Electric Railway Traction Supplement* for May 27, were made by Heemaf N.V., of Hengelo; Smit, of Slikkerveer; and the Metropolitan-Vickers Electrical Co. Ltd., at Sheffield. The Metrovick motors are of modern light-weight construction, of the axle-suspended, box-frame type, and are designed for high-speed motor-coach service on a normal line voltage of 1,500; two motors are permanently connected in series. The drive is transmitted through single reduction gearing situated at the end of the motor remote from the commutator, and the gear ratio is 21:61 and the road wheel diameter 900 mm. (35½ in.). Field weakening is provided by means of a tapping on the main series field coils.

The motor is self-ventilated, air being drawn through the machine by means of a fan mounted on the armature at the pinion end of the machine. Increased air volume is obtained by a system of dual ventilation in which the air passing through the armature core is taken in through openings in the commutator end housing; the air which passes over the armature and between the field coils enters through separate openings in the yoke, adjacent to the commutator end of the field coils.





Two views of the Metrovick nose-suspended motors as used on the new Dutch trains

The armature is mounted on roller bearings, and these are protected from the possibility of the passage of current through them by the provision of a specially designed earth return brush gear. This consists of insulated brush gear carrying brushes which make contact with the axle. The arrangement has two brush holders operating in parallel, one on the vertical centre line and the other on the horizontal centre line. The object of this is to ensure that there is always at least one brush making contact with the axle, as any impact which is likely to lift the vertical brush would not affect the horizontal brush, and *vice versa*. The brushes fitted are of copper with special silver contact tips and are connected by insulated leads to the equipment. The axle bearings are of the sleeve type lubricated by oil and waste.

The ratings of the motor, to B.E.S.A. specification No. 173/1928, Class B Insulation, are:

One hour	235 h.p.	285 amp.	675 volts	1,080 r.p.m
Continuous	180 h.p.	220 amp.	675 volts	1,200 r.p.m

The design has special features adopted to conform with special weight restrictions within which the given output had to be defined. One of these features is the use for the armature of slots of taper section, giving teeth of parallel section in place of the more common arrangement of parallel-sided slots and taper teeth. This arrangement, which is utilised in conjunction with conductors of corresponding taper section, allows more effective use of material in the available space.

Publications Received

Meters.—An eight-page publication (No. S32A) describes with illustrations the house service meters made by the English Electric Co. Ltd., and covers standard ratings of 2½, 5, 10, 25, and 50 amp. for 200-250 volts 50 cycles supply.

Asea Supervisory System.—A 15-page brochure with this title has just been issued by Asea Electric Limited, of Walthamstow, London, E.17. It describes in full detail the Asea supervisory system as used for the remote control of the rectifier substations and track-paralleling huts on the Southern Railway electrified lines. The system has already been described in the pages of this Supplement when dealing with the successive main-line extensions of the Southern, but the present publication goes into the details more thoroughly, and includes several drawings and half-tone illustrations never published previously. A RAILWAY GAZETTE map and power supply and distribution diagram are incorporated.

Power Transformers.—Among developments during recent years in power transformation equipment, and which are particularly applicable to areas of moderate to high load density where only one feeder circuit per transformer is used, is the new Westinghouse CSP (completely self-protecting) transformer. It combines the functions of voltage transformation, automatic regulation, automatic switching, thermal protection, metering, and complete lightning protection. It includes equipment for automatic on-load tap-changing. The principles of operation, schematic diagrams of connections, and a characteristic curve of this type of transforming apparatus are included in a brochure (Descriptive Data No. 211) sent by the Westinghouse Electric & Manufacturing Company, Sharon Works, Pa., U.S.A.

NEW SOUTH WALES UNDERGROUND PROPOSALS.—It is reported that definite action is afoot to construct an electrified underground railway to serve the eastern suburbs of Sydney, which at the moment have only tram and bus services. The first section of the proposed line stretches from near Museum underground station to Bondi Junction station, and eventually will be prolonged to Bondi Beach.

NOTES AND NEWS

Manchester-Sheffield Substations.—The L.N.E.R. has now issued its specification for the equipment required for the mercury arc rectifier substations of the Manchester-Sheffield main line, now being electrified on the 1,500-volts d.c. system.

Pneumatic-Tyred Motor-Coach.—A 136-seater Michelin pneumatic-tyred motor-coach has been placed in experimental service on the St. Lazare-Pont Cardinet-Auteuil 600-volt electrified line of the French National Railways. It has a total traction motor horse-power of 650, a tare weight of 32 *tonnes*, and is intended for a top speed of 115 km.p.h. (71 m.p.h.).

Italian Rolling Stock Programme.—The Italian State Railways are now taking delivery of 99 electric locomotives, 8 streamlined three-car electric trains, and 56 electric motor-coaches. Further orders have been placed for 122 electric locomotives, and 78 motor-coaches. Practically all of the motor-coaches are of the streamlined type designed for solo working, or for coupling in multiple unit with another coach of the same type.

Rhaetian Railway News.—The Board of the Rhaetian Railway has authorised the acquisition of four light-weight motor-coaches, with a maximum speed of 65 km.p.h. (40 m.p.h.), and eight light-weight passenger coaches, involving a total expenditure of Swiss fr. 1·7 million. The report of this system for 1937 shows fr. 3,666,356 net receipts, or 1,335,632 more than in the previous year, and the operating ratio was reduced from 77·79 to 67·98.

New Zealand Tests.—The English Electric locomotives for the Wellington–Paekakariki section of the New Zealand Government Railways (see issue of this Supplement for February 4, 1938) are being tested on the Wellington–Johnsonville suburban line. One of them recently hauled a 12-car train from Wellington to Johnsonville, six miles with grades up to 1 in 40, in 25½ min., and in 20½ min. on the return trip, making four intermediate stops in each direction.

Pennsylvania Electric Locomotives.—The General Electric Company and the Westinghouse Electric & Manufacturing Company, have each obtained orders worth $1,700,000, for electrical equipment for ten new streamlined locomotives for passenger service on the electrified section of the Pennsylvania Railroad between New York, Washington, and Harrisburg. Six twin motors, each of 770 h.p., will be used, each twin set driving one axle. The normal rating is 4,620 h.p., as in the existing GG. 1 class, but a short-time output in excess of 8,000 h.p. will be possible.

Control of Melbourne Suburban System.—The Victorian Government Railways are to adopt a system of supervisory control for the power supply and distribution system of the extensive 1,500-volt d.c. suburban lines radiating from Melbourne. An air-conditioned control room is to be erected at Batman Avenue, near Flinders Street station, and will house three separate control systems with corresponding illuminated diagrams, regulating the 1,500-volt overhead contact lines, the 2,000-volt signal circuits, and the 20 kV. high-tension supply system respectively.

Jugoslav Electrification.—It has been decided to proceed with the electrification of the main line of the Jugoslav State Railways leading out of the Adriatic port of Sušak to Skrljevo and ultimately to Ogulin, which is a heavily-graded line with numerous tunnels and constant curves. The present proposals are to adopt the 15 kV. single-phase system as used in Central Europe, although at Fiume the line joins the Italian State Railways' 3,000-volt d.c. system. Italian electric interests are associated with the scheme, and one of the schemes put forward even proposed to supply current to the line from a power station in Italy. Another project is for the Italians to build a hydro-electric plant on the River Korana, in Jugoslavia. The necessary credits for the first portion of the electrification work have been allowed in the Jugoslav budget.

Success of the Pilatus Electrification.—Figures now available regarding the first season of electric operation on the Pilatus Railway, viz., from May 15 to November 10, 1937, show that electrification of the line was fully justified. The preliminary estimates provided for transportation of 33,000 passengers with Swiss fr. 4,880 expenditure on current supply; actually, 100,846 passengers were carried, but current costs amounted only to fr. 9,413, this including the numerous trial trips before the annual re-opening of the line. Receipts for the year were fr. 264,783, as against fr. 113,824 in 1936, but working expenses were only very slightly increased, the figures being fr. 127,930 and fr. 104,268 respectively. The estimated cost of fr. 1·1 million for the whole electrification project was exceeded only by fr. 12,390, but as the amount covers several items not originally planned, such as additional protection works and a service telephone installation, the scheme was actually carried out at well under the estimated figure.

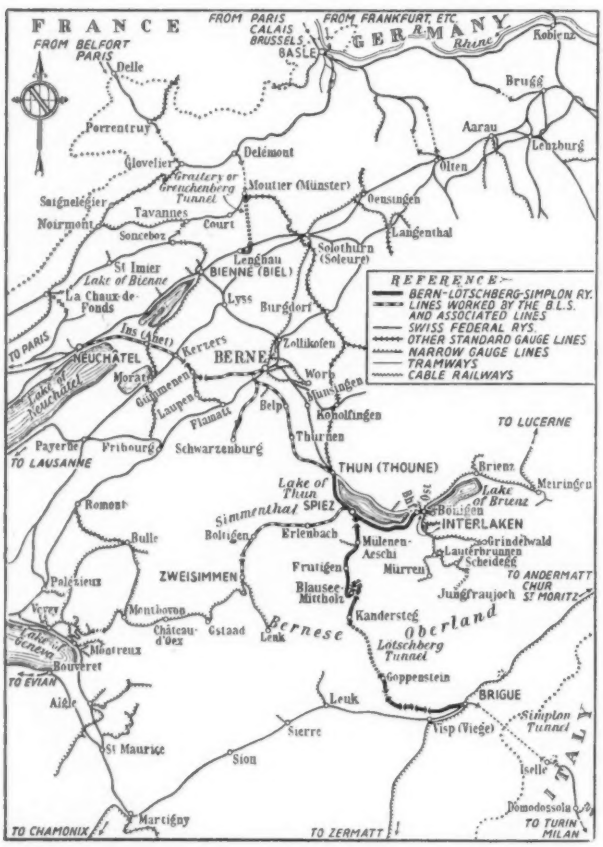
Rand Electrification.—Fourteen electric locomotives of 1,200 h.p. are to be used by the South African Railways on the Germiston–Pretoria section when the electrification of that line is completed. An electric service will begin about the middle of October, and will be operated by 10 or 12 motor-coaches with trailers, of the type now in use on the Reef lines. The electric locomotives will be put into traffic about a month later and will be used for working the heavier long-distance main-line trains to and from Pretoria. Once the electric service is in operation steam locomotives will almost disappear from the Germiston–Pretoria division, and the new service will be gradually speeded up until the journey time of a fast train will be under 60 min. compared with the 80 min. of the present fast steam trains. The delay in the electrification of the section under consideration is due mainly to the great amount of work which has been entailed in practically relaying the line, doubling portions of the track, and constructing deviations. One of the biggest deviations, that between Pretoria and Lyttleton, is just being completed, and another, between Elandsfontein and Germiston, will not be finished until later in the year. The traffic over this section has become progressively heavier owing to increased traffic from the northern Transvaal and to and from the Iscor steel works at Pretoria. To help in dealing with the increased passenger traffic, six new platforms are being built at Germiston.

50 Years of New Haven Electrification.—The New York, New Haven & Hartford, on May 2 last, celebrated 50 years of electric traction on its lines, by placing on display in the Grand Central terminal, New York, eight electric locomotives, representing the evolution of electric motive power from the very beginning of its use in line haul service. At one end of the exhibit line was placed the first electric locomotive used for freight service on any railroad in the United States. Built in 1888, the car-like vehicle was operated in pioneer service on the Ansonia,

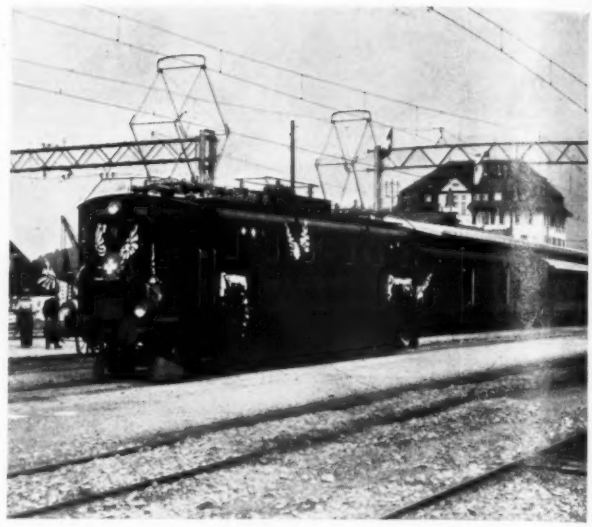
Birmingham & Derby electric line, which later became part of the New Haven system. At the other end of the line was placed the first of six new streamlined passenger locomotives which the New Haven is receiving from the American General Electric Company, each of which has a continuous rating of 3,600 h.p.

Traction Motor Patent.—The Westinghouse Electric & Manufacturing Company has patented (Specification No. 482,506) an improvement to traction motors to allow of better space utilisation, particularly in regard to the interpoles and their coils. The suggestion is made that the pole-piece end be provided with two sides which are virtually parallel to one another. Each side has cut in it a slot which is perpendicular to the axis of the pole piece; the slots are fitted by an apertured plate used for holding the coils. The plate has two closed ends which join the parallel sides of the pole piece, and is arranged to be easily removable from the pole piece by bending it near an opening in its end.

Lötschberg Anniversary.—The silver jubilee of the Lötschberg Railway, the pioneer European line in single-phase electric traction for heavy main-line traffic, occurred on July 15. The top illustration on this page shows one of the original I-E-I electric locomotives making up the special train for the inaugural trip from Spiez to Brigue. Actually, the Spiez-Frutigen section was opened and worked electrically from July 25, 1901, but the traffic was of a local character; the Frutigen-Brigue section was not opened until July 15, 1913, and was worked electrically from the beginning. In the I-E-I locomotives illustrated considerable vibration occurred in the driving rod system, and the investigations then made have formed the base of nearly all the succeeding European rod drive systems. Two geared single-phase Oerlikon motors with an individual output of 1,250 h.p. on the 1½-hr. rate were installed, and after some time in service flexible gear wheels were substituted for the original solid wheels. The 13 original locomotives, built conjointly by Oerlikon, Brown Boveri, and the Swiss Locomotive Company, worked all the heavy traffic, with the assistance of a few motor-coaches, until 1926, when two Secheron-Breda 4,500 h.p. 1-Co + Co-1 locomotives were introduced to haul unassisted 550-ton trains up the maximum grade of 1 in 37. Two similar locomotives were delivered in 1931. Light-weight motor-coaches have been introduced during the last few years for working the local traffic on the Lötschberg and its associated lines.



Map of the Lötschberg and associated railways. The Lötschberg Railway built the isolated Lengnau-Moutier line in 1915 in order to improve the connections between the Lötschberg route and the French Eastern Railway



One of the original I-E-I Lötschberg locomotives, with a top speed of 75 km.p.h., making up the inaugural train at Spiez, July 15, 1913

L.P.T.B. Substation Orders

SEVERAL important contracts for electrical equipment in connection with the northern and north-east extensions of the tube system have been placed by the London Passenger Transport Board. The order for equipment for 12 pumpless rectifier substations placed with the General Electric Co. Ltd. has already been mentioned in these columns (see page 192, July 22 issue of this Supplement). More recently, the English Electric Co. Ltd. has received important contracts from the London Passenger Transport Board in connection with the electrification of the board's northern line extension to Elstree. The contracts comprise ten supervisorily-controlled rectifier substations, and include twenty-one 1,500 kW. steel-tank mercury-arc rectifiers, 11 kV. switchgear, power transformers, d.c. switchgear, low-tension a.c. switchgear, remote supervisory control gear, and cables.

The Metropolitan-Vickers Electrical Co. Ltd. has also received a £37,000 contract from the London Passenger Transport Board, for the supply of motor-generators and switchgear for installation in 21 substations under construction—10 on the northern and 11 on the north-eastern tube extensions.

RECTIFIER PLANTS AND COMMUNICATION INTERFERENCE

Experiences in South Africa

FOLLOWING the extensions of the Natal electrified main lines of the South African Railways from 1935 onwards, when rectifier substations, some arranged for regeneration, were installed for the first time, considerable interference with communication circuits was experienced. In the first extended section—from Daimana to Harrismith—no filters for the elimination of d.c. harmonics were provided, with the result that it was hardly possible to speak over the telephone lines adjacent to the electrified tracks.

The substations involved were two forward-and-regenerative substations with three rectifiers each, and one single-unit forward substation on the Daimana—Harrismith line; one double forward-and-regenerative substation with four rectifiers and four forward-and-regenerative substations with two rectifiers each between Durban and Cato Ridge; and four forward-and-regenerative substations with two rectifiers each and two single rectifier forward substations between Glencoe and Volksrust. The high-tension supply in all cases is 88 kV. 50 cycles three-phase, and on the d.c. side the normal rated output of the rectifiers is 1,500 kW. 500 amp., 3,000 volts. The regulation characteristic is flat-compounded, that is, the equipment is designed to maintain the d.c. voltage constant within ± 2½ per cent. of 3,000 volts from 1,580 amp. rectifying to 770 amp. with inverted operation, on the assumption of an a.c. supply voltage constant in magnitude and wave form at the primary terminals of the transformer.

The experiences of the South African Railway's staff in eliminating this serious interference has been described at length in a valuable paper read before the South African Institute of Electrical Engineers by Mr. A. J. E. Funke, and an abstract of this paper follows.

Smoothing circuits comprising a d.c. reactor of 10 mH in the rectifier positive connection in addition to the already existing 25 mH inverter reactor (in series with the inverter positive connection), as well as four filters tuned to the 6th, 12th, 18th, and 24th harmonics were ordered, and it was anticipated that with this extra apparatus the amplitude of all d.c. voltage harmonics up to 1,200 cycles per sec. would be reduced to approximately 0·5 per cent. or less, *i.e.*, the interfering effect of the complete equipment would be reduced to a level as low as in the best rotating machines. The characteristic data of the four shunts are:—

D.C. Harmonic	Effective Resistance (ohms)	Capacity (μ F)	Inductance (mH)
6th (300 c.p.s.) ..	·75	15·4	18·3
12th (600 c.p.s.) ..	1·73	5·0	14·17
18th (900 c.p.s.) ..	1·63	2·5	12·55
24th (1,200 c.p.s.) ..	1·62	1·9	9·355

When these filters were installed it became obvious that their total effect was by no means as great as originally anticipated, in fact, the residual noise voltage in the telephone lines still remained objectionable. Subsequent tests revealed that an appreciable linkage existed between the filters and the forward—as well as inverter reactor, due to their proximity and the presence of a number of iron rails which had been placed in the ceiling of the filter cubicle in order to allow this ceiling to carry the weight of the reactors. This linkage was overcome by removing the filters from the cubicle.

Further modifications had to be made since it was established that due to the earthing of the neutrals of all transformers a considerable noise voltage was induced in the communication circuits. The neutral-to-earth current in the transformer at Van Reenen substation at 600 amp. load and the unearthed neutral at Colworth substation had a measured R.M.S. value of 5·5 amp. At other times values up to 8 amp. were measured. All neutrals were, therefore, disconnected from earth, but a not altogether negligible residual noise voltage still remained, varying continuously in strength and tone. Tests indicated that this was general, apart from the question of the position of trains in the section, taking into consideration that the trolley wire is not split between the substation but joined through, *via* the busbars.

The telephone pole route is not always on the left-hand side of the track structure, but crosses the track at certain points, depending on the nature of the country. The route adjoins the track for the whole of the distance with the exception of short cross-country sections, the separation between trolley wire and telephone circuits varying from 15 to 40 ft., the average separation being approximately 25 ft.

All communication circuits have metallic return and are fairly well balanced. Two single-channel carrier as well as repeatered voice frequency circuits—besides station to station, selector and telegraph circuits—are accommodated on the same pole route and transposed according to British Post Office and American standards.

6th Harmonics

From the commencement of the general investigations it was found that the value of the 6th harmonic current in the 300-cycle tuned circuit varied over a wide range and at times reached 88 amp., which is well over double the current that should exist, the current through the 6th harmonic filter being 87 amp. The reason becomes clear when considering the high-tension voltage, which shows a 5th harmonic of about 17 per cent., the phase of which would increase the value of the 6th harmonic on the d.c. side. As even higher percentages of 5th harmonic voltages had been observed it will be seen, that under such conditions, the 300-cycle shunts were called upon to smooth two or three times the value of the 6th harmonic voltage that would exist with the supply voltage approximating to a sine wave. The result was overheating and final destruction of several of the shunt coils.

Viewed from an interference point of view, it is obvious that the residual 6th harmonic voltage in the 3,000-volt overhead contact line increases correspondingly under such conditions. Referred to the effective filter resistance and a 6th harmonic filter current of 87 amp., the residual 6th harmonic voltage is $87 \times 0{\cdot}75 = 65$ volts, a value which naturally caused serious interference.

In order to eliminate the destruction of the 6th harmonic filters and to reduce the residual voltage in the trolley wire, arrangements were consequently made for the temporary doubling of the 300-cycle shunts. The 6th and 12th harmonic current waves are of the form $\cos 6\ wt\ (a + b \cos 2\ wt)$ and $\cos 10\ wt\ (b \cos 2\ wt + c \cos 5\ wt)$ respectively. The original harmonics giving rise to these waves are 4, 8, 6 and 8, 12, 5, 15—the 4th and 8th arising from unbalance, the 5th and 15th probably from dissymmetry in the transformer since the trolley wire is disconnected.

A design of filter circuits supplied for several of the

Reef substations had given satisfactory results in that area, and it was, therefore, thought that a similar combination, embodying the quadrupled original 6th harmonic filter, would give equally good results in Natal. The characteristic data of the new resonant shunts are:—

Harmonic shunt	Capacity (μ F)	Inductivity (mH)	Effective Resistance (ohms)
6th (300 c.p.s.) ..	62	4·54	0·2
12th (600 c.p.s.) ..	50	1·41	0·233
18th (900 c.p.s.) ..	20	1·56	0·438
24th (1,200 c.p.s.) ..	10	1·76	0·72

After the complete installation of this type of shunt in all substations of the Glencoe-Volksrust section, it became evident that the presence of these filters created a precarious situation. The trolley was excited into partial resonance at a frequency of 150 cycles per sec. Since the effective filter resistance at that frequency is approximately 6·7 ohm, and as total filter currents of 150 amp. were measured, the serious aspect of such partial resonance will at once be realised. Provided that the conditions are such that no resonance will result, the reduction of the residual d.c. harmonics, as compared with oscillograms taken with the original filters in circuit, become strikingly noticeable. In all cases of non-resonance the a.c. wave form is rather good, but oscillograms indicate that the distortion of the h.t. voltage is not necessarily bound up with the question of partial resonance. The second critical frequency lies at about 400 cycles per sec.

Resonant shunts having very much greater reduction factors (*i.e.*, smoothing circuits employing very much greater capacities for a given series reactor) have to be carefully designed from the point of view of critical frequencies since they can under conditions of very small unbalance, or dissymmetry, or harmonics in the a.c. supply, fail to hold the trolley circuit to such low interference factors; in fact, such designs can not only magnify certain harmonics coming through from the a.c. supply, but are liable to cause resonance.

In the case of the lowest of the critical frequencies of the equivalent circuit corresponding to 150 cycles per sec., considerations have shown that there are various factors which have a possible bearing on the question of resonance. The six-phase rectifier may have properties under such conditions that it reverts to three-phase operation. The frequencies appearing in the d.c. circuit under such conditions constitute a serious interference problem in itself, especially when taking into consideration that their amplitudes become extremely high.

Effects of Partial Resonance

It is suggested that the following effects which were experienced during normal service conditions may be attributed to conditions of partial resonance. (1) Flash-overs on the main motors and motor-generator sets of the electric locomotives, due to the increased current density under the brushes. (2) Distinction of d.c. feeder breakers when opening under fault conditions, due possibly to the fact that the blow-out principle which embodies iron-cored series coils, is rendered ineffective. (3) Failure of line contactors on the motor-coaches to open load under both normal and fault conditions. These contactors also employ series iron-cored blow-out coils for rupturing the arc. There have further been inexplicable failures of the O.C.B. to open in the case of backfires, a matter which is receiving very close attention.

As the installation of 5th harmonic acceptor circuits does not counteract all the factors that make the performance of the previously-described shunts so onerous, it will be realised that other smoothing designs have to be adopted, unless it be found that with filters, similar to those originally supplied working in conjunction with acceptor circuits, reasonable freedom from interference due to trolley wire coupling is obtained. When reviewing the problem from this point of view, considerations will of necessity lead to a design which is generally termed blanket smoothing, *i.e.*, a large condenser connected between trolley wire and ground, in addition to one or two resonant shunts tuned to the lowest frequencies which are fixed by the rectifier itself. Naturally, the condenser capacity has to be so large that it cannot partially resonate or magnify any harmonics of a frequency higher than 100 cycles per sec.

Blanket Smoothing

Objections to the application of blanket smoothing have been raised, especially in respect of possible deleterious effects on the d.c. feeder breakers, but it is suggested that the presence of such a large condenser is, if anything, helpful rather than detrimental to the operation of the breakers. Although the initial discharge current impulse in cases of short circuits is high, this discharge through the arc takes place rapidly, so that after the extinction of the arc the return voltage across the breaker is less than at normal operation, thus preventing a re-striking of the arc as often experienced. In any case, there exist simple means to limit and fix the maximum short circuit currents that can flow from the condenser, *e.g.*, a small resistance of the order of, say, 0·3 ohm in series with the condenser.

Regarding the general question of the safety factor for such condensers, it must be taken into consideration that overhead lines will necessarily receive at times voltage surges arising from lightning and from switching, which owing to the extended nature of the line will travel along it and give rise at various points in the installation to potentials of very considerable magnitude. On 3,000-volt traction lines surges may be expected which will reach between 10,000 and 20,000 volts peak. These values will occur when the line has only a small capacity connected to it, or its natural capacity only. The larger the condensers that are connected across the line, the greater the reduction that will take place in these peak voltages, since the condensers by their natural character readily absorb such transients. With a large capacity connected at all substations as suggested at the outset, a considerable limitation of the possible peak voltage of these surges is to be expected, so that it would be possible to employ condensers having a lower safety factor than would be necessary if peak voltages up to about 20,000 were likely to occur. When connecting condensers of this magnitude between trolley and earth, the fact should not be overlooked that the voltage regulation characteristic of the grid-controlled rectifier is modified due to the presence of this condenser, in that the characteristics for various ignition angles now converge in one point which is slightly higher than that fixed by $a = O°$ and zero load. As regards the design of the apparatus installed, this feature is, of no importance.

In all cases where the amplitudes of the 5th, 7th, 11th, and 13th harmonics appearing in the a.c. voltage are comparatively high their presence in the communication circuits will at once be detected. As far as the even harmonics are concerned, arising from partial resonance with the trolley wire, it will be found that their presence in the communication circuits is invariably more noticeable, due to the inherently greater coupling at such high frequencies. Although their weighting factor is comparatively small, it has definitely been found that their presence in the telephone lines is most objectionable, since they do not appear as well defined tones, but as noises like hissing, thus seriously impeding the intelligibility.